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FROM

The Warden

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FORESTRY

EIGHTH ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

OF

MINNESOTA.

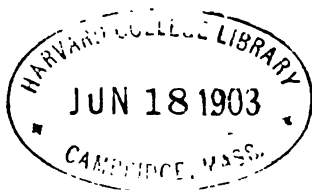
UNDER THE ACT OF THE LEGISLATURE ENTITLED
"AN ACT TO PROVIDE FOR THE PRESERVATION OF FORESTS OF THIS STATE AND FOR
THE PREVENTION AND SUPPRESSION OF FOREST AND PRAIRIE FIRES,"
APPROVED APRIL 18, 1895, AND AS AMENDED BY
THE ACT OF APRIL 21, 1903.

FOR THE YEAR 1902.

ST. PAUL, MINN.:
PRINTED BY THE PIONEER PRESS COMPANY
1903.

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APR 18 1941

The Warden,

BOUND DEC 2 1909

STATE OF MINNESOTA,
OFFICE OF CHIEF FIRE WARDEN,
ST. PAUL, MAY 1, 1903. }

Hon. S. G. Iverson, State Auditor and Forest Commissioner:

SIR: As required by section 3 of the Act for the Preservation of Forests, etc., approved April 18, 1895, amended by the Act of April 21, 1903, I have the honor to submit, herewith, my annual report for the year 1902.

Very respectfully,

C. C. ANDREWS,

Chief Fire Warden.

EIGHTH ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

OF MINNESOTA.

Wet weather in the summer and autumn of 1902 was favorable for the prevention of forest fires, and but few occurred. Dry and dangerous weather, however, prevailed in the northern part of the state in April and May, and most of the fires which were reported occurred in those months. The number of forest fires reported—and mostly on brush and cut-over land—was 34; estimated number of acres burned over, 18,285; damage, \$3,820.

Number of prairie (and field) fires reported, 46; estimated number of acres burned over, 31,928; damage, \$12,318.

Extracts from the reports of fire wardens, printed below, show that in a number of cases serious damage was prevented by the prompt service of fire wardens and their helpers. I believe it can be truly said that each year shows increased attention on the part of fire wardens to their duties. These officers are town supervisors, elected the second Tuesday of March, and many of them each year are new to the work.

SUMMARY OF FOREST AND BRUSH FIRES, 1902.

COUNTY AND TOWN.	Date.	Acres.	Damage.	Cause.
Anoka County— Bethel.....	April 4.....	600	\$50	Unknown.
Becker County— Grand Park.....	Oct. 19.....	200	.....	From White Earth Res.
Holmesville.....	Oct. 9.....	10	15	Unknown.
Beltrami County— Bear Creek.....	Oct. 18.....	640	250	Unknown.
Benton County— Glendorado.....	April 7.....	400	200	Clearing land.
Glendorado.....	April 25.....	40	20	Clearing land.
St. George.....	Oct. 7.....	70	200	Hunters.
Sauk Rapids..	Oct. 19.....	200	600	R. R. locomotive.
Carlton County— Barnum.....	April 9.....	40	Brush	Unknown.
Cass County— Becker.....	April 18.....	5,000	{ Brush & Weeds.	Unknown.
Chisago County— Branch.....	Mar. 27.....	30	40	R. R. locomotive.
Wyoming.....	Mar. 27.....	20	195	R. R. locomotive
Crow Wing County— April 25.....		120	None	Clearing land.
Hubbard County— Nevis.....	April 19.....	1,500	100	Fishermen.
Nevis ..	Oct. 20.....	5	5	Unknown.
Isanti County— North Branch.....	May 5.....	60	10	Tramp.
Oxford.....	Mar. 28.....	400	Slight.	Unknown.
Stanchfield.....	April 18.....	800	Slight.	Clearing land.
Kanabec County— South Fork.....	Mar. 27.....	2,400	500	Clearing land.
Marshall County— Excel.....	Oct. 4.....	800	150	Hunters.
Mille Lacs County— Onamia.....	April 20.....	2,000	None	Unknown.
Morrison County— Pike Creek.....	April 14.....	15	79.60	Burning meadow.
Pine County— Eastern.....	April 19.....	5	None	Clearing land.
Hinckley.....	April 14.....	200	150	Clearing land.
Kettle River.....	April 15.....	160	200	Clearing land.
St. Louis County— Mesaba.....	April 4.....	80	200	Unknown.
Town. 54-20.....	May 18.....	600	15	Unknown.



Mature Norway pine 20 inches in diameter breast high, Big Fork River, 1902.
(By Mr. T. S. Woolsey, Jr.)

SUMMARY OF FOREST AND BRUSH FIRES, 1902—*Continued.*

COUNTY AND TOWN.	Date.	Acres.	Damage.	Cause.
Stearns County— Melrose.....	Mar. 15.....	300	100	Burning meadow.
Todd County— Birch Lake.....	Mar. 20.....	200	150	Unknown.
Fawn Lake.....	April 7.....	1,200	75	Unknown.
Iona.....	April 18.....	800	200	Unknown.
Little Sauk.....	April 27.....	20	100	Unknown.
Wadena County— Rockwood.....	April 8.....	70	15	Unknown.
Wright County— Clearwater.....	April 19.....	300	200	Unknown.

Total acres burned over, 18,285. Damage, \$3,820.

Classification of causes:

Clearing land, 8.

Railroad locomotives, 3.

Burning meadows, 2.

Other causes, 5.

Unknown, 16.

REPORT OF FIRE WARDENS AND OTHERS OF FOREST FIRES FOR 1902.

ANOKA COUNTY.

P. W. Jasperson, chairman, town of Bethel, April 12:

On the 4th instant, about 12 o'clock, a fire started on land occupied by Joseph Cogger; burned over 600 acres of brush and meadow, and destroyed 20 tons of hay. The fire was stopped by a back-fire. Weather dry and windy; had been for about a week.

BECKER COUNTY.

Peter O. Dahl, chairman, town of Grand Park, October 30:

On the 19th instant fire burned over 200 acres of light timber on section 3. It originated in a meadow

on the White Earth Indian Reservation on the 17th instant and was brought into this town by hard wind; was extinguished by three men digging and cutting a break through timber and brush. Weather was very dry and windy; had been so about two months.

BELTRAMI COUNTY.

H. C. Teigland, chairman, town of Bear Creek, October 20:

On the 18th instant a fire, supposed to have been caused by some railroad employe on section 28, burned over about 640 acres of partly timber and partly meadow land. Fire burned white pine logs to the amount of \$200 and hay to the amount of \$50. I do not figure damage on standing timber, as it will be cut this winter. The fire was extinguished by Emil Oleson, fire warden, assisted by five men. The weather had been dry for about six weeks, and the 19th was very windy.

BENTON COUNTY.

Jens P. Anderson, chairman, town of Glendorado, April 22:

On the 7th instant, fire which originated on section 22, burned over 400 acres of timber, brush and meadow land; did damage to the amount of \$200. It was extinguished by back-fires, by digging and using wet sacks. The weather was dry and windy; had been dry for about six weeks.

Same, May 1:

The latter part of April a fire in the northwestern part of the town burned over 40 acres of brush and meadow and destroyed about 11 cords of wood; damage \$20. Weather was dry and windy; had been so for a month.

W. J. Stewart, chairman, town of Granite Ledge, September 23:

About the 18th of September a fire on section 34 started, I suppose, from someone setting an old rotten log on fire. It caught in some other rotten logs and was burning a few places in the ground, and, if it had not been discovered, would after a while have spread and done some damage. It was extinguished by hauling water with teams.

John Wilson, chairman, town of St. George, October 8:

October 7th a fire on section 1 burned over 70 acres of light timber; destroyed 9 tons of hay, a shanty and contents, small stable and some timber. Damage \$200. It was extinguished by back-firing, carrying water and wetting grain sacks and slapping the fire out. It is the general opinion that it was caused by hunters, as the woods are full of them. Three hunters came and assisted in extinguishing the fire. Weather dry and windy; had been for two weeks.

G. S. Reeder, chairman, town of Sauk Rapids, October 21:

On the 19th instant a fire on section 4, which started from the railroad track, or near it, burned over 200 acres of brush and meadow. Damage \$600. The weather was windy; had been for two days.

CARLTON COUNTY.

Thomas Spencer, chairman, town of Barnum, April 25:

April 9th fire on section 11 burned over about 40 acres of brush and field. It was extinguished by nine persons beating it out. There had been no rain this spring previous to the fire.

CASS COUNTY.

George Lewis, chairman, town of Becker, April 28:

A swamp and brush fire burned over a quarter part of the town, destroying old weeds and brush. Controlled by back-firing, plowing and on roads. Everybody assisted. Rain April 22nd stopped the fire. Very dry and windy some of the time; had no rain until now. People here have been clearing land since the middle of March. Have not known anyone to let fire get from their control. A number of fires started on vacant land, but have been stopped without damage, as far as I know.

CHISAGO COUNTY.

Robert Striker, chairman, town of Branch, April 3:

March 27th a fire set by a railroad train on land occupied by C. E. Elmgren, destroyed about 20 cords of cord wood. Damage \$40. It was extinguished in six hours with the help of eight persons throwing sand and water. Weather very dry and windy.

George Kappler, chairman, town of Wyoming, April 3:

On the 27th of March, the weather being dry, with a heavy wind, fire was set in three different places in one mile by the ten o'clock railway train running north. Damage \$195. Fire was extinguished in five hours with the help of thirty-one persons using water and wet sacks.

CROW WING COUNTY.

H. G. Butterfield, Cross Lake, May 12:

On the 25th of April fire, which originated on land occupied by Nels Garden, on section 24, town of Eagle Lake, burned over 120 acres of light timber; destroyed nothing but underbrush. Fire was not hot enough to damage the pines. It was whipped out with branches of green brush. Weather was partially dry, with light winds.

HUBBARD COUNTY.

James K. Deyo, chairman, town of Nevis, May 10:

On the 19th, 20th and 21st of April, a fire which burned over sections 31, 32 and 33, in the town of Nevis, being township 140, range 33, did damage to the amount of \$100. It originated on section 33, being land occupied by Fred White. It started near the bridge on the Crow Wing river at the head of 4th lake. It was extinguished with the help of eight persons by plowing, back-firing and whiping same out; weather very dry and windy. It is supposed to have been started by fishermen. For about three weeks in April, while fish are running in between 4th and 5th lakes in Crow Wing river, hundreds of barrels of fish are taken out, salted and taken home by settlers who come from fifty miles around and camp about the river and fish. Wagon loads of fish are taken by net at one haul. Fire was traced to one of the camps, but no one has been able to locate parties who left the fire burning. Now that the fish have stopped running, there will be no more danger until next spring.

M. Mikel, Fire Warden, town of Nevis, November 10:

On the 20th of October a fire burned over about 5 acres of Jack pine on section 7. Damage \$5. It was extinguished by myself. Weather was dry and windy for four weeks.

ISANTI COUNTY.

A. P. Ledin, chairman, town of North Branch, May 9:

On the 5th instant a fire caused by a tramp, as near as can be found out, burned over 60 acres of brush and meadow; destroyed some hay. Damage \$10. It was extinguished by back-firing and ditching.

C. J. Olson, chairman, town of Oxford, April 3:

March 28th a fire originating on section 16 burned over 400 acres of meadow and light timber and

destroyed open oak, mostly dead and down. Very little damage done. It was extinguished by eight persons by starting cross-fires and using old sacks wet. Weather was dry and windy; had been so about two weeks.

Leonard Groth, chairman, town of Stanchfield, April 23:

On the 18th of April, about 11 A. M., a fire burned over 800 acres of brush and light timber and destroyed a little fencing; damage amounted to very little. Fire was set by a party burning weeds and other combustible material. A strong wind blowing at the time brought the fire into a tamarack swamp overgrown with long grass and it quickly spread to the brush and timber. Weather was very dry and windy, as there has been no rain of note this spring. The fire was extinguished with the help of forty persons by plowing, using wet sacks and back-firing. It had to be watched for three days. The party who caused fire was arrested, plead guilty and paid a fine of \$50.

ITASCA COUNTY.

R. M. Dering, Fire Warden, town of Rippel, on the Big Fork, near Grand Falls, October 19:

There have been no fires in this section of the country this season; none anywhere along the northern part of the state. The swamps are wet and there is no danger of fires doing any damage this fall.

KANABEC COUNTY.

Henry T. Olson, chairman, town of South Fork, April 15:

March 27th a fire burned over 2,400 acres of partly meadow, partly brush and partly heavy timber; mostly hard maple. Did damage to the amount of \$500. As near as I can find out, it was caused by a settler clearing land. It was extinguished by the work of ten



Part of the Forest Reserve, Chippewa Reservation. Photographed by Mr. Herrell for the Annual Report of the Chief Forest Fire Warden of Minnesota, July, 1902.

persons by back-firing around new settlers' houses and along roads with wet sacks. The weather had been dry for twenty days and a heavy gale was blowing from the southwest.

MARSHALL COUNTY.

James Roach, chairman, town of Excel, November 12:

October 4th a fire, which originated on section 11, being vacant land, and supposed to have been started by some boys or hunters, burned over 800 acres of brush and prairie and destroyed 60 tons of hay; damage \$150. Ten persons helped extinguish the fire by plowing, using wet sacks and brooms. Weather was dry for about six weeks before the fire, and windy also.

MILLE LACS COUNTY.

E. W. Cundy, chairman, town of Onamia, April 25:

On the 20th day of April a fire which originated on vacant land on section 33, from cause unknown, burned over about 2,000 acres. No damage. Weather dry and windy. The fire was extinguished in forty-eight hours by rain.

MORRISON COUNTY.

Anton Webber, chairman, town of Pike Creek, April 21:

April 14th a fire, caused by burning meadow, burned over 15 acres of meadow and timber on section 7. Damage \$79.60. It was extinguished in four hours with the help of nine persons with water and brush. Weather dry and windy. Party admitted setting the fire and was prosecuted.

OTTER TAIL COUNTY.

Andrew Johnson, chairman, town of Eastern, April 24:

On the 19th of April a fire on section 12 burned over 4 or 5 acres of brush and stubble. It was extinguished in an hour by two men before any damage was done. Weather dry and windy. Party causing the fire was prosecuted.

ST. LOUIS COUNTY.

Frank Remmell, chairman, town of Mesaba, April 7:

On the 4th instant a fire caused by unknown parties, possibly by some iron ore prospectors, who are very numerous in this locality at present, burned over 80 acres of light timber and destroyed a small quantity of standing dead timber. Damage \$200. It was extinguished by rain and snow storm on the night of the 5th instant. On Saturday evening I cut down several dry pine trees that were burning, which, together with rain and snow, extinguished the fire.

John Hillman, Fire Warden, unorganized town, 54-20,
July 2:

May 18th a fire on section 19 burned over 600 acres of brush and meadow; destroyed about 40 rods of fence. Damage \$15.

TODD COUNTY.

Paul Oldenburg, chairman, town of Fawn Lake, April 25:

April 7th a fire, which originated on section 5 in the town of Turtle Creek, burned over 1,200 acres in the southwest part of Fawn Lake and, destroyed brush, meadow, light timber, 18 tons of hay and 3 cords of wood. Damage \$75. It was extinguished by plowing, back-firing and using wet sacks. Weather dry and windy; had been dry for two weeks.

On the same day there was a fire on section 17, which destroyed hay to the value of \$25. This fire was extinguished in six hours.

Edward Paulson, chairman, town of Iona, April 23:

April 19th and 20th a fire, which originated on section 26, burned over 800 acres of timber and meadow; destroyed about 15 tons of hay and some cord wood. Damage \$200. Fire was extinguished by plowing and using wet sacks. Weather has been dry all spring, and windy.

WADENA COUNTY.

J. A. Collins, chairman, town of Rockwood, April 19:

April 8th a fire burned over 70 acres of meadow and small timber; destroyed small undergrowth. Damage \$15. The cause of the fire is unknown. It was quite a fire. There was a school house and number of hay stacks in great danger, but by the good services of Chris P. Aarnes, fire warden, and his men, they saved \$500. They did some very good work back-firing and whipping out fire with wet sacks. Weather very windy and dry.

WRIGHT COUNTY.

Peter Nelson, chairman, town of Clearwater, May 1:

On the 19th of April, in the afternoon, a fire, which originated on vacant land on section 25, from cause unknown, burned over 300 acres or more of meadow, heavy and light timber; destroyed hay, wood and standing timber. Damage \$200. It was extinguished with the help of six men. The weather was dry; had been dry for weeks—in fact, months.

SUMMARY OF PRAIRIE, FIELD AND MEADOW FIRES, 1902.

COUNTY AND TOWN.	Date.	Acres.	Damage.	Cause.
Aitkin County— Hazelton.....	Sept. 6	40	\$200	Burning brush.
Anoka County— Columbus	Mar. 26.....	600	75	Unknown.
Ham Lake.....	Mar. 20.....	1,000	55	Burning meadow.
Ham Lake.....	Mar. 29.....	3,000	150	Burning meadow.
Benton County— Langola.....	Nov 3.....	170	50	R. R. locomotive.
Mayhew.....	April 12.....	40	60	Unknown.
Watab.....	April 2.....	300	None	Burning grass.
Carlton County— Barnum.....	April 2.....	60	80	Burning stubble.
Clay County— Barnesville.....	Sept. 12.....	160	300	Unknown.
Barnesville.....	Sept. 13.....	1,600	1,000	R. R. locomotive.
Barnesville.....	Sept. 28.....	130	300	Unknown.
Felton.....	Sept. 23.....	200	105	R. R. locomotive.

SUMMARY OF PRAIRIE, FIELD AND MEADOW FIRES, 1902—*Cont.*

COUNTY AND TOWN.	Date.	Acres.	Damage.	Cause.
Clay County—<i>Cont.</i>				
Highland Grove....	Oct. 14.....	240	760	R. R. locomotive.
Riverton.....	Sept. 18.....	100	120	Burning hay stack.
Viding.....	Nov. 23.....	40	50	Lighting cigar.
Chippewa County—				
Woods.	Oct. 14.....	800	1,500	Burning stubble.
Kittson County—				
Hill	Oct. 19.....	2,000	1,200	Unknown.
Lac qui Parle County—				
Manfred	April 17.....	1,380	266	Unknown.
Marshall County—				
Agda.....	Oct. 17.....	1,000	11	Unknown.
Comstock.....	Oct. 18.....	2,000	300	Burning grass.
Foldahl.....	Oct. 4.....	250	150	Hunters.
Grand Plain.....	Oct. 22.....	400	300	Hunters.
Grand Plain.....	Nov. 1.....	10	125	Burning hay stack.
Moylan.....	Oct. 21.....	2,500	30	Hunter.
Sennott.....	Sept. 25.....	160	225	Burning straw.
Morrison County—				
Pike Creek.....	Oct. 15.....	200	96	Unknown.
Ottertail County—				
Bluffton.....	Aug. 26.....	6	60	Boys.
Compton.....	April 27.....	350	150	Unknown.
Pine County—				
Rock Creek.....	April 20.....	40	35	Unknown.
Polk County—				
Helgeland.....	Oct. 4.....	400	100	Burning straw.
Kersonville.....	Sept. 24.....	1,200	2,000	R. R. locomotive.
Parnell.....	.....	.....	.....	.....
Swift County—				
Clontarf.....	April 18.....	3,000	600	Unknown.
Clontarf.....	Oct. 12.....	200	100	R. R. locomotive.
Clontarf.....	Oct.....	400	70	R. R. locomotive.
Wadena County—				
Meadow.....	April 4.....	4,000	100	Unknown.
Wilkin County—				
Akron.....	Sept....	80	90	Burning stubble.
Andrea.....	Oct. 21.....	10	25	Unknown.
Andrea.....	Nov. 9.....	800	300	Burning old hay.
Kent	Oct. 20.....	2	60	Unknown.
Manston.....	April 17.....	600	75	Unknown.
Meadows.....	Oct. 19.....	1,200	50	Tramps.
Mitchell.....	Sept. 27.....	80	250	Unknown.
Roberts.....	Oct. 6.....	300	50	Burning straw.
Yellow Medicine Co.—				
Florida.. ..	April 18.....	640	135	R. R. locomotive.
Fortier	Sept. 28.....	120	500	Burning straw.
Norman	Nov. 21.....	170	50	Travelers.

Total acres burned over, 31,928. Damage, \$12,318.

Classification of causes:

- Burning brush, 1.
- Burning grass or meadow, 4.
- Burning haystacks, 3.
- Burning straw, 4.
- Burning stubble, 3.
- Hunters, 3.
- R. R. locomotives, 8.
- Other causes, 4.
- Unknown, 16.

REPORTS OF FIRE WARDENS OF PRAIRIE, FIELD AND MEADOW FIRES, 1902.

AITKIN COUNTY.

F. R. Nichols, chairman, town of Hazelton, September 16:

On the 6th of September, 3 P. M., a fire, caused by burning brush on land occupied by Peter Reither, burned over 40 acres of meadow; did damage to the amount of \$200. It is not out yet, but was put under control with the help of seven persons plowing, ditching and hauling water. Weather very dry and windy.

ANOKA COUNTY.

Frank Hoffman, chairman, town of Columbus, April 15:

March 26th, a fire originating on section 16, burned over 600 acres of field, brush and meadow. Damage \$75. It was extinguished in six hours with the help of 15 people, and by plowing. Weather was dry and windy; had been dry for a few weeks.

Charles J. Lundberg, chairman, town of Ham Lake, April 22:

March 20th, a fire burned over sections 22, 23, 24 and part of 26; destroyed 23 tons of hay, and did damage to the amount of \$57. The American Grass Twine Company clears a lot of land and burns the old

grass, and perhaps the fire originated in that way. We set back-fire along a public road and ditch. Weather has been dry all spring.

BENTON COUNTY.

Peter Stodvlka, Fire Warden, town of Langola, November 7:

On the 3rd instant, a fire set on section 1 by the N. P. train, burned over 170 acres. Damage \$50. It was extinguished in four hours by myself, wife and children, by plowing, raking and using wet sacks. The wind was blowing 60 miles an hour, and if the fire had not been extinguished it would have done damage over \$6,000.

G. Golenbeck, chairman, town of Mayhew Lake, May 21:

April 12th, a fire originating on section 22, occupied by Mr. Reimer, burned over 40 acres of meadow and destroyed 20 tons of hay. It went out after reaching the plowed land. Weather had been dry and windy for about three weeks.

Nels Campbell, chairman, town of Watab, May 1:

April 2d, a fire on section 22, unoccupied, burned over 300 acres of brush and meadow. It burned to the road and plowed fields, and could go no further. It might have burned about 30 tons of hay. Weather had been dry for some time, and very windy.

CARLTON COUNTY.

Thomas Spencer, chairman, town of Barnum, April 15:

On the 4th instant a field fire, caused by burning stubble, burned over several acres and destroyed 16 tons of hay. Damage \$80. The weather had been dry since the snow disappeared.



Sections of Norway pine 30 inches in diameter and 200 years old on the Winnibigoshish reservation. A mixed blood of the Chippewas.
Photographed for the Chief Forest Fire Warden of Minnesota, July, 1902.

CHIPPEWA COUNTY.

J. D. Beninga, chairman, town of Woods, October 15:

On the 14th instant a fire, caused by burning stubble with a fire-break of only two furrows and, a strong wind blowing from the southwest, burned over 800 acres of field and prairie; destroyed hay, grain and one building. Damage \$1,500. About 20 persons helped control the fire by plowing fire-breaks in fields.

CLAY COUNTY.

R. Sieber, chairman, town of Barnesville, September 17:

On the 13th of September, a fire set on vacant land on section 9, by locomotive of Great Northern Railway Company, burned over 1,600 acres of prairie land, and destroyed a large amount of hay. Damage \$1,000. It was extinguished by plowing ahead of fire. Weather dry and windy.

Same, October 2:

September 12, a fire burned over 160 acres on sections 15 and 16, and destroyed hay stacks. Damage about \$300. It was extinguished by using wet sacks. Weather dry and windy.

Same, October 2:

September 28th, a fire burned over 200 acres on section 19. Damage \$300. Was controlled by plowing. The weather was dry and windy.

Thomas Barry, chairman, town of Felton, September 25:

September 23d, a fire, caused by a railroad locomotive, burned over 200 acres on section 4, and destroyed 35 tons of hay. Damage \$105. It was extinguished in six hours by plowing and using wet sacks. Weather had been windy for about four days.

C. J. Cederberg, chairman, town of Highland Grove,
October 18;

On the 14th of October, about noon, a fire, caused by sparks from an N. P. railroad locomotive, burned over

240 acres on sections 17 and 21; destroyed 190 tons of hay. Damage \$760. The same locomotive set fire four times through our town at the same time. It was extinguished in five hours with the help of forty persons by plowing, shoveling and whipping with wet sacks. Weather had been dry for three weeks.

Edward Weaver, chairman, town of Riverton, September 20:

September 18th, at 2 P. M., a fire, supposed to be set by a man unknown to me, by burning an old hay stack bottom, burned over 100 acres of meadow on section 17; destroyed seven stacks of hay. Damage \$120. It was extinguished in four hours by plowing. Weather dry for two weeks; wind south.

R. O. Stevenson, chairman, town of Viding, November 28:

On the 23d of November, a fire, supposed to have been caused by persons lighting cigars, burned over 40 acres of prairie land; destroyed about 10 tons of hay, stacked. Damage \$50. Was whipped out with wet sacks by seven persons.

KITTSOON COUNTY.

J. J. Bienek, chairman, town of Hill, October 26:

October 19th, in the morning, a fire that came from St. Vincent township, burned over 2,000 acres in the northeastern part of this town; destroyed hay and buildings. Damage \$120. There was quite a crowd fighting the fire, but on account of illness I was not there. Weather has been both dry and windy the whole season.

LAC QUI PARLE COUNTY.

Charles Roske, chairman, town of Manfred, April 20:

On the 17th of April, about 2 P. M., a fire, which originated on section 21, being land occupied by Anton Smith, burned over about 1,380 acres of prairie land; destroyed two stacks of hay, three bridges and one barn.

Damage \$266. Three persons assisted in controlling the fire by plowing and whipping it out. Weather was dry and windy and has been nearly all spring.

MARSHALL COUNTY.

G. Gunderson, chairman, town of Agder, December 13:

October 17th a fire, which originated on section 9, vacant land, burned over 1,000 acres of meadow. Damage \$11. The fire was pounded out with wet rags, eleven persons helping.

J. M. Laeslie, chairman, town of Comstock, October 24:

October 18th a fire burned over sections 4, 5, 8, 9 and 10. Did damage to the amount of \$480. The parties causing fire were prosecuted. The fire was extinguished mostly by plowing. Weather had been dry for four weeks.

Otto S. Haug, fire warden, town of Foldahl, October 10:

October 4th a fire, supposed to have been caused by chicken hunters, burned over 250 acres in the southwest part of the town; destroyed 6 stacks of hay. Damage \$150. It was extinguished by plowing and using brush brooms and water. Weather very dry and windy.

Henry Roller, fire warden, town of Grand Plain, November 2:

October 22nd a fire caused by hunters burned over 400 acres of prairie; destroyed 40 tons of hay and one house with 40 bushels of grain. Damage \$300. It was extinguished by rain. The weather was dry and windy most of summer.

Same, November 2:

On the 1st instant a fire, caused by burning old hay, spread over 10 acres of field; destroyed one barn and 30 tons of hay. Damage \$125. It was extinguished by plowing.

A. D. Brown, fire warden, town of Moylan, October 23:

October 21st a fire, supposed to have been caused by a boy hunting, burned over 2,500 acres of meadow, prairie and light timber; destroyed 3 or 4 tons of hay and part of corduroy on county road. Damage \$30. It was extinguished with the help of thirty persons plowing fire breaks, back-firing and whipping out with brush and wet sacks. Weather dry and windy; had been dry for two months.

August Lundin, chairman, town of Sinnott, Sept. 27:

On the 25th of September, a fire, caused by burning straw on land occupied by E. Johnson, burned over 100 acres; destroyed a house and barn. Damage \$225. It was controlled by plowing. The weather had been dry for three weeks and windy.

MORRISON COUNTY.

Anton Webber, chairman, town of Pike Creek, Oct. 21:

On the 15th instant, a fire which originated on vacant land in section 27, from cause unknown, burned over 200 acres of timber and meadow; destroyed 4 cords of hard wood and 24 tons of hay; damage \$96. Extinguished by hauling water and using wet sacks. Weather dry and windy; had been dry for two or three weeks.

OTTER TAIL COUNTY.

J. C. Johnson, chairman, town of Bluffton, September 4:

August 6th, a fire on section 27, land occupied by Mr. Noehle, burned over 6 acres of field and destroyed 200 bushels of oats; damage \$60. Controlled in one hour by plowing around it. It looks as if some boys had set the fire. I have inquired, but do not think I can get evidence enough to convict. Weather was very dry but not windy; have not had any rain for two months.

Addison Petrie, chairman, town of Compton, May 8:

April 27th, a fire which started on section 5, being land occupied by Mr. Newell, burned over 300 to 400 acres of meadow, brush and light timber; destroyed 4 tons of hay. It also burned the grove around J. R. Dennison's house—he was away. Hired one man to watch house at night. Weather dry and windy although it had rained two days before.

PINE COUNTY.

F. P. Dey, chairman, town of Rock Creek, April 26:

April 20th, a fire on section 30 burned over 40 acres of meadow and destroyed 50 tons of hay; damage \$35. Think it was started by some boys. It was extinguished in twelve hours by the work of fifteen persons plowing, back-firing and with water. Weather dry and windy; had been dry thirty days.

POLK COUNTY.

Christian Anderson, chairman, town of Helgeland, October 13:

October 4th, a fire in the northwestern part of the town burned over 500 acres, and destroyed 25 tons of hay in the stack. Damage \$100. It was extinguished by fighting with wet rags, and by plowing. Weather dry and windy; had been dry for a week or more.

Pierre La Rochelle, chairman, town of Kersonville, Oct. 20:

On the 24th of September a fire, which started on section 31, by an N. P. railroad locomotive, burned over 1,200 acres of prairie and field; destroyed hay and grain. Did damage to the amount of \$2,000. It was extinguished with the help of six persons, by plowing furrows in front of it. Weather dry and windy.

John W. Ralston, clerk, town of Parnell, October 24.

On the 6th instant, a fire swept the country for several miles around, many farmers losing their hay and grain. Myself and family labored hard in fighting the fire. I

suffered loss of about \$300. Fire is supposed to have been set by the section men employed by the Great Northern Railway Company.

SWIFT COUNTY.

M. F. Wagner, chairman, town of Clontarf, April 28:

On the 18th of April a fire, which originated on section 11, burned over 3,000 acres of wild meadow, and destroyed 200 tons of wild hay; damage \$600. Cause unknown. It was extinguished in five hours by the work of 13 men and two teams. Weather very dry, with strong wind from north.

Bert Anderson, chairman, town of Clontarf, February 23, 1903:

On the 12th of October a fire, originating on section 26, caused by sparks from a railroad locomotive, burned over about 200 acres; destroyed hay and straw stacks. Did damage to the amount of \$100. Weather very dry and windy; had been dry for some time. Fire was extinguished by the work of 15 persons—some with teams and plows, others with sacks and shovels, to pound it out. Same, March 5, 1903:

In the latter part of October a fire, which started from the east side of the railroad track, just as the train passed by, burned over 400 acres, and destroyed hay and straw stacks to the value of \$70.

WADENA COUNTY.

J. B. Kelly, chairman, town of Aldrich, November 3:

On the 30th of October a fire, caused by a railroad train, burned over 12 acres of meadow and brush, but did no damage. Seven persons extinguished it with plows and shovels.

Charles Harmes, chairman, town of Meadow, April 12:

April 4th, a fire, which started at night and ran the next day, burned over south half of town; destroyed 30



View from high point showing Agate and Gull Lakes on land in Cass county donated by the late ex-Gov. John S. Pillsbury to the state of Minnesota for forestry purposes.

tons of hay. It was set by parties unknown; supposed to be set by someone passing along the town line road. The owners of the hay burned would not help put out the fire; said the hay was not worth it, and as the rest of us had all we wanted to do guarding our own, we had to let it burn itself out. It went out after it struck high ground. Weather dry and windy.

WILKIN COUNTY.

Emil E. Brown, chairman, town of Akron, November 3:

Sometime in September, a fire caused by burning stubble on land occupied by Anton Kyone, burned over about 80 acres and did damage to the amount of \$50. Weather had been dry about a month. The fire was extinguished by plowing and with wet sacks.

Ralph Murphy, chairman, town of Andrea, October 31:

October 31st, a fire on section 11 burned over 10 acres of meadow; destroyed one threshing machine belt and damaged separator. The machine was left on said ground at twelve o'clock previous to the fire. It is supposed fire was in separator when left. It was extinguished with the help of three persons by plowing and whipping with wet sacks. Weather was dry but very little wind at the time.

Same, November 14:

On the 9th of November, a fire, originating on section 1 by burning old hay, burned over 800 acres of meadow and destroyed about 15 tons of hay; damage \$300. The party was prosecuted for causing the fire and settled for damage.

C. Longevin, chairman, town of Kent, October 24:

October 20th a fire on section 11 burned over 2 acres of field and did damage to the amount of from \$50 to \$75. It was whipped out with wet sacks by three persons.

L. Lomsdalen, chairman, town of Manston, April 17:

April 8th a fire in the evening burned over about a section of land and destroyed a bridge; damage \$75.

Frank Sorenson, chairman, town of Meadows, October 31:

October 19th about four o'clock P. M. a fire, originating on section 33, being land occupied by Geo. Demoret, burned over 1,200 acres wild prairie and destroyed 50 tons of old hay that had been standing in water all summer; damage \$50. As near as I can find out it was caused by two tramps who were traveling across the prairie smoking. Two threshing crews helped extinguish the fire by plowing furrows and setting back-fires. There was only a little breeze; it had been dry for two days.

G. J. Czichotzki, chairman, town of Mitchell, October 20:

On the 27th of September between twelve and one (I cannot find out how the fire was caused) a fire burned over 80 acres and destroyed 200 bushels of wheat and about 600 bushels of oats. The fire was extinguished with plows and shovels. Weather still and dry.

M. Waybel, chairman, town of Roberts, October 22:

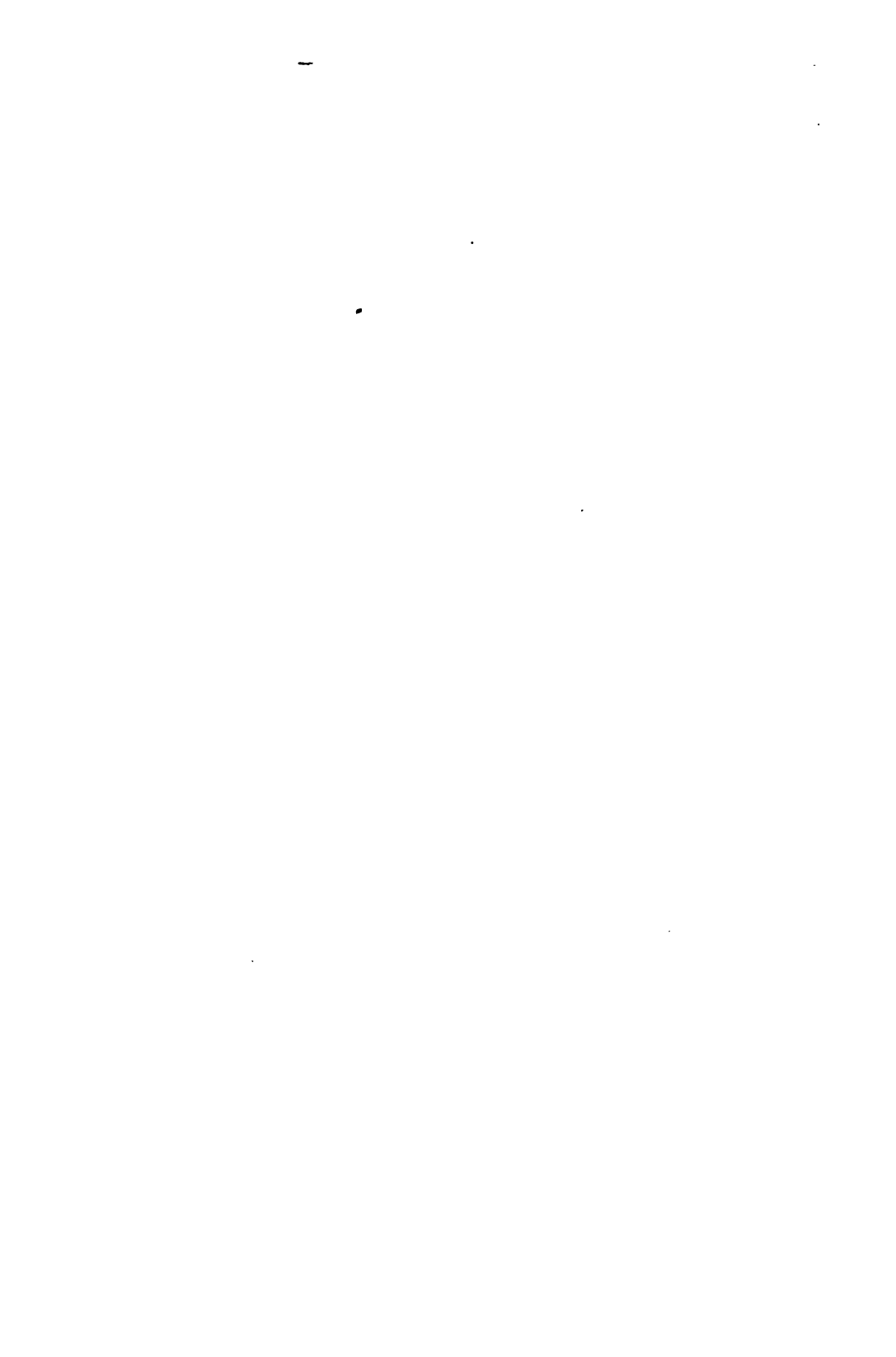
October 6th at two P. M. a fire, originating from burning straw stacks on section 1, burned over about 300 acres and destroyed some flax; damage \$50. It was extinguished in three hours by eight persons with wet rags and shovels and two men with four horses each on two gang plows. Weather very dry and windy for the last six weeks.

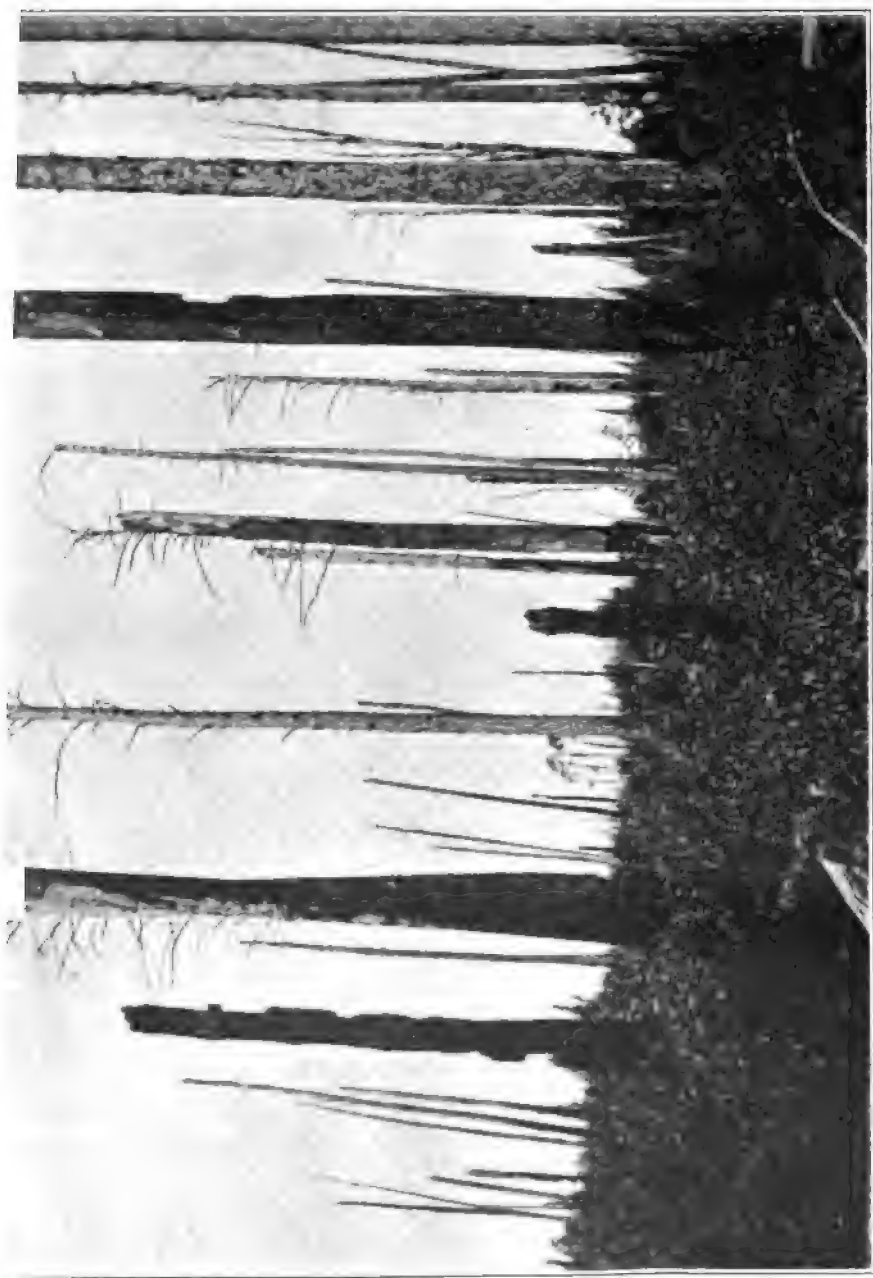
YELLOW MEDICINE COUNTY.

Chresten Olsen, chairman, town of Florida, April 21:

April 18th a fire, caused by sparks from a railroad locomotive, burned over 640 acres of field and prairie land and did damage to the amount of \$135. Weather was dry and windy; had been dry for two months.

B. H. Melby, chairman, town of Fortier, September 29:





Ruin wrought by fire in a once splendid pine forest on the Winnibigoshish Indian Reservation. Photographed for the Annual Report of the Chief Forest Fire Warden, July, 1902.

September 28th at one P. M. a fire, originating on section 33, occupied by M. Victor, and caused by burning a straw stack the previous day, spread over 120 acres of stubble and prairie; destroyed 15 stacks of grain. Damage \$500. The fire was extinguished in two hours by plowing and pounding with sacks. Weather dry for one day. Party who set the fire is willing and able to settle for the whole loss.

E. O. Helgemo, chairman, town of Norman, Nov. 24:

On the 21st instant a fire on section 7, caused by some party driving in lumber wagon (we have been tracing the track but have not found the party yet) burned over 170 acres of prairie and meadow and destroyed 50 tons of hay; damage \$50. It was extinguished in four hours by fifteen persons; by using breaking plow and furrow, where we could, and wet rags.

THE BARBARISM OF FOREST FIRES.

The forest fires that have occurred in this state in the last eight years have generally done more damage by burning hay, and wood that would be valuable for fuel, than in the destruction of timber. Such fires often run for many miles, following meadows, and there have been many cases where all forage of the poor settler has been destroyed, making it necessary for such settler to dispose of his only cow, the means of sustenance for his children through winter. Not unfrequently all the members of the family have to turn out and work with all their might to save their humble home from the flames. The prevalence of fires, at night especially, are a source of great terror to families in scattered settlements thus exposed. To see a mother flying with her children from such a danger is pathetic. The most dangerous fires are caused by the inexcusably negligent habit of setting fire to clear land in dry and dangerous weather and let-

ting the fire run. Every respectable citizen, or man of good conscience, would refrain from setting fire in extremely dry weather; or if he set fire, he would first pile his brush and dig or carefully make a break around it to absolutely prevent the fire from spreading. To set fire and let it run wild and do, nobody knows how much, injury to other people, is a lazy and half-civilized practice.

Great forest fires in the Northwest have been caused by just such negligence.

In October, 1871, such a fire devastated 400 square miles of territory in Wisconsin by wiping out several villages, including Peshtigo, causing the loss of a thousand lives, the destitution of 3,000 people and damage of \$3,000,000.

Another such fire as that was in the southeastern part of Michigan, September, 1881, which ran over 48 townships, and in which 138 people perished and over \$2,000,000 worth of property was destroyed.

The Hinckley fire in Minnesota originated about three miles southwest of Brook Park, Pine county, Minnesota, and was burning slowly for several days before September 1st, the day of the great calamity, when 418 people perished. The material loss, but not including timber, which the people sustained, amounted to \$750,000. The relief furnished to the sufferers, nearly all from private contributions, amounted to \$184,744.

It is a striking fact that the present penalty against negligence in causing fires, which is now in force, formed a part of the law at the time of the Hinckley fire, but there were no officers specially designated at that time to have it enforced. I believe that if the present fire warden system had been in operation in 1894 the Hinckley fire would not have occurred.

Strange as it may seem, there are some people who appear to think that the state should take no precautions for preventing forest fires. Why, the state itself owns

neatly 3,000,000 acres of school and state institution lands, scattered principally in the forest regions, on which is much valuable timber, and for the protection of its own property could afford to spend ten times as much as it now spends for the prevention of forest fires. It is the duty of the state to prevent forest fires, if only to preserve its scenery and landscape. These are things which belong to the public.

The cities and villages in Minnesota spend in the aggregate \$2,000,000 a year to prevent and control fires.

The prevalence of forest fires in the state is an indication of disregard of law, of negligence, of poor administration and of a low state of morals. They cast a blemish on the state's reputation for good government and civilization. They tend to lower its standing before the rest of the country. The taking of precautions to prevent fires, such as the posting of warning notices, the warning of the careless and the prompt prosecution of those who violate the law, also the diffusion of information of the principles of forestry and the value of the forests, will gradually tend to do away with the evil of forest fires and make them of as rare occurrence in this state as they are in the civilized countries of Europe.

NEW YORK'S SYSTEM.

The State of New York in 1885 made town supervisors fire wardens, and that system was in use for twelve years, when the practice was adopted which is still in force of appointing a fire warden for each town in the sixteen counties containing land belonging to the "Forest Preserve." The charge for fire warden service is paid by the town in which the service is rendered. The state then pays one-half. New York has a Chief Fire Warden, also a State Superintendent of Forests. During the dry season of 1899 the number of acres burned over in that state was 79,000, damage \$86,893; and the amount paid to fire wardens and their helpers was \$41,659.

PENNSYLVANIA'S SYSTEM.

In Pennsylvania the constables are made fire wardens. The towns there first pay the expense and the state pays one-half. There is a Forestry Commissioner and a Forestry Reservation Commission, of which the Forestry Commissioner is President, that is authorized to purchase any suitable land for forest preservation at not exceeding \$5 per acre.

Some other states have constituted town supervisors fire wardens, but, not having an official to supervise the work, the systems have been practically in abeyance.

MINNESOTA'S SYSTEM.

Our Minnesota system makes town supervisors fire wardens. Such officers are generally men of some influence in their town. They travel through the town on town business, and, although by the annual elections they are frequently changed, yet the system is better than we could expect unless the state paid for fire warden service much more than it now does.

Under the present law our fire wardens must post warning notices, take precautions to prevent fires, which naturally includes the warning of people likely to be careless; when a fire occurs to call help—every able-bodied male eighteen years of age and upward is liable to be called—and extinguish it. Fire wardens are paid \$2 a day for services when rendered but for not exceeding fifteen days in the year.

The county commissioners have to audit fire warden accounts. The county pays for the service and the state, by the law as now amended, repays the county two-thirds of the amount. Some counties have heretofore been backward in paying fire wardens for their services, but it is believed it will lead to more certainty of pay for the state to pay two-thirds of the expense. Efficient service cannot be expected where there is no pay.

People will turn out without pay to protect their near neighbors' property, but they will not go off some miles distant to put out a fire which does not threaten present danger.

A MORE EFFICIENT SYSTEM.

Let anyone assume for a moment that he is going to undertake the work of preventing and controlling forest and prairie fires. What would be his plan? What the most effective and at the same time the most economical system? Would he not think that the best plan would be to find in each town a good, energetic man who would attend to the work in his town? What would he have to pay such a man? Such a man would have to make it for the interest of two or three other good men in distant parts of the town to watch and report to him in dangerous seasons, and he would have to pay them a little. In case citizens were called to help extinguish a fire, they would be paid as is the case at present. Now, assume that the best plan would be to employ one good, energetic man for the service in each town, how much would we have to pay him a year to secure his faithful service? Would we expect to get him for less than \$50 a year? Well, there are six hundred townships in this state requiring and receiving fire warden service. The annual expense therefore of employing a good, efficient man in each town at \$50 a year would amount to \$30,000 annually, without counting the pay of citizens who turn out and help extinguish fires. There is the cost of what one might call an efficient system.

Under the present system of making supervisors fire wardens, and which was adopted on grounds of economy, the present cost of fire warden service does not average \$10 in each town annually. And here is the point which deserves attention—the present fire wardens receive so little pay that it throws so much the more work upon the

chief fire warden to inspire them with interest and zeal and keep them on the alert.

DIFFICULTIES THAT ARE MET WITH.

Remember the great extent of territory—about 30,000,000 acres—that our fire warden system has to protect; a country containing hundreds of logging camps, thousands of new settlers clearing land, land and timber seekers, mineral prospectors, campers, hunters and tourists, all in large numbers; a country full of activity and attended with great danger in respect to fires. These are facts to be considered when judging of the efficiency of the fire warden system.

Remember, too, how many there are in this region who are naturally hostile to any such system, and who themselves, and by their mouthpieces, slur and belittle it. This class of people embraces those professional hunters who are mean enough, in a dry and dangerous season, to set fires in the woods in order to make pasture for deer; also men who make a living by stealing timber. Such men naturally do not want any agents of the law around.

Also, there are multitudes of well-meaning settlers, who, not thinking of the future and of their own best interests, wish an indiscriminate removal of all the woods in their locality.

DUTIES OF THE CHIEF FIRE WARDEN.

What are the duties of the supervising officer, who, under our system, is entitled the Chief Fire Warden? In the first place, he is practically a Forest Commissioner. He is required by law to investigate the extent of forests in the state, the amounts and variety of timber growing therein, the methods used to promote regrowth of timber, and other important facts relating to forest interests. Such information and his suggestions are to be included in his annual report. He must be a man well informed in the science of forestry.



On the U. S. Forest Reserve. Pure and ideally close stand of young Norway pine on the Winnibigoshish Chippewa reservation. Photographed July, 1902, for the Annual Report of the Chief Fire Warden of Minnesota.

He has authority to mass the whole fire warden force of the state at any necessary point of danger. He is intrusted with the expenditure of the emergency fund of \$5,000 in a dangerous season. An officer with this authority should not be a cheap man.

This officer appoints fire wardens in unorganized territory. He instructs the local fire wardens as to their duties. He must inspire them with interest to perform their duties faithfully. The principal object of the law is *prevention*—to have precautions taken against fires; and the local fire wardens, during the dangerous seasons, must be kept on the alert to guard against fires; otherwise the system would have very little value. The supervising officer is just as responsible for the efficiency of the fire warden service as a colonel is responsible for the behavior of his regiment in action.

RESULTS.

Since the Minnesota fire warden system went into effect there have been forest fires in each of our neighboring states, Michigan, Wisconsin and South Dakota, that have done damage exceeding a million dollars. Of course there have been some fires in this state, but there have been no such fires as occurred in the above mentioned states. There is a hundred million dollars worth of forest still standing in Minnesota which has not been injured by fire, and besides, many thousand acres of young and growing forest which have not been injured by fire. These facts speak for themselves. Still, the service is not as effective as it ought to be made, for it is a work of educating the public living in the vicinity of woods to the exercise of proper care.

FIRE WARDEN SYSTEM STRENGTHENED BY THE LAST LEGISLATURE.

The legislature which has just closed strengthened the fire warden law of 1895 by the following twelve

amendments, in the act approved April 21, 1903. By these amendments—

It is made the duty of each fire warden to patrol his district in a dry season, or, under the direction of the Chief Fire Warden, to employ one or more patrols.

To warn against careless use of fire any person he thinks is likely to be negligent therein.

Any fire warden who knows or has information of facts and circumstances which he believes can be established, and which if so proven would show beyond reasonable doubt that any person has caused a fire in violation of this act, shall immediately go before a justice of the peace and make complaint thereof.

Chairmen of town boards, without delay, to inquire into cause of forest or prairie fires and immediately report same to Chief Fire Warden.

Fire wardens shall promptly comply with the instructions of the Chief Fire Warden.

Where local authorities neglect to duly prosecute violations of this act, the Chief Fire Warden shall be authorized to ferret out and prosecute such violations, and his expenses therefor, not exceeding one thousand (\$1,000) dollars in any one year, shall be paid out of the general revenue on approval of the State Auditor and Attorney General.

Use of a team when required in making a break to control or extinguish a fire, may be paid for.

Two-thirds of expense by counties for fire protection services to be paid by the state and one-third by the county.

Verification of accounts can be made before any officer qualified to administer oaths, or before any fire warden or town clerk.

Any account of services under this act which the county commissioners shall fail to audit within ninety days succeeding the second meeting of the board after the same

shall have been presented shall be deemed to have been rejected, and the claimant may then appeal to the district court or to the Chief Fire Warden, and the decision of either shall be final.

Helpers to be paid for not exceeding ten days' service in any one year.

The limitations "five" days posting notices and "ten" days preventing and extinguishing fires are stricken out; and fire wardens may be paid for fifteen days' service if rendered. The bill, as introduced, did not change the Chief Fire Warden's salary, but the committees recommended an increase from \$1,200 to \$1,600, which was agreed to by the House. It was, however, stricken out by the Senate.

APPROPRIATION.

For each of the first two years that the fire warden law was in operation, the legislature, under the head "For Forest Preservation," appropriated \$6,000, which was to cover the one-third of expense the state paid to counties, and the salary, printing and other expenses of the Chief Fire Warden. Since then the appropriation for each year for those purposes has been only \$5,000. The legislature appropriated no more for each of the two ensuing fiscal years, although the state will have to pay an additional third of county expenses. It will be necessary, therefore, to keep expenses as low as possible.

FOREST SOUTHEAST OF RED LAKE.

Three hundred miles northwest of the Twin Cities and in a region covering twenty townships east and southeast of Red Lake is one of the largest and richest forests of original white pine remaining in Minnesota. Starting in the latter part of September last from the village of Black Duck and going east to within about ten miles of the Big Fork river, thence north, I made a circuit of sixty miles through this forest, passing through eight townships and the settlements of Island Lake, Phena, Mizpah and

Bridgie. The surface of the country is moderately undulating. The pine is mixed with spruce, balsam, white and yellow birch, poplar and maple, with intervening swamps of cedar and tamarack. There are occasional pure stands of white and of Norway (or red) pine, but generally the pine is mixed with large leaved trees. The soil is a black sandy loam with a subsoil of yellow clay and gravel, and will all be good for agriculture and sustain a large population.

As indicating the richness of this forest, some quarter sections (160 acres) are known to contain 2,000,000 feet board measure of pine, and worth \$12,000. Generally the white pine trees are of medium size, but there are some which singly will yield 5,000 feet of lumber. The United States has parted with its title to practically all of this splendid forest, mostly under the homestead law, partly by sale, under the stone and timber act, at \$2.50 per acre, and by the location of scrip. (I have elsewhere discussed these ways in which Congress allows the United States pine lands to be disposed of.) The pine is mostly in the possession of lumber companies and will be cut and removed, if times continue prosperous, within the next eight years. It is safe to say that the value of this pine as it stands is \$12,000,000. Some of it will be floated down streams into Red Lake, thence into the Red River valley and the Dakotas; but the most of it will reach a market over the Minnesota & International Railway, the rails of which are laid ten miles beyond Black Duck, and which is heading for the Big Falls of the Big Fork river. Branch logging railroads are being built from this road through the forest.

Considering the newness of the settlements, it is perhaps surprising that the roads are as good as they are. They can be traveled except in an unusually wet spell, but the stumps and roots left in the roadway make it impossible for a team to go faster than a walk, and there

is need of almost constant winding out and around to avoid bad places. Itasca county has lately appropriated \$1,500 to be divided equally among five new towns for road building, namely Bartlett, Bridgie, Cormorant, Fairview and Island Lake.

ALONG THE IRON RANGE.

In October last I went from Virginia north sixteen miles through hilly forest of principally pine and cedar on the new Duluth, Virginia & Rainy Lake Railroad and within eight miles of the Little Fork river whose valley, like those of the Big Fork and Rat rivers, contains a great deal of public agricultural land that is being rapidly settled, and which still affords golden opportunities for actual homestead settlers.

This new railroad, which is reaching out about one hundred miles to Rainy Lake at Koochiching, and being built by experienced railroad men, will tap eight million dollars worth of standing pine, a good agricultural area beyond, and make a new and important route for wheat from the Winnipeg region to Duluth. It will also increase the value of much land owned by the State of Minnesota.

During eight years I have annually or oftener visited some of the mining cities and villages on the Iron Range, of which there are about a dozen, and apparently they never were more prosperous than to-day. I stopped at four of these on this trip, and was impressed by the steadiness of their growth, their clean streets and the neatness and comfort of the workingmen's homes. To see these thriving young towns—with their mile or two distant border of autumn colored woods—connected with a network of busy railroads, in some instances with good carriage roads, with fine school houses and swarms of well behaved and handsome children, where but a few years ago was a dense wilderness, impresses one with the greatness of his state.

PLATFORM OF THE FRIENDS OF FORESTRY IN MINNESOTA.

Beginning about a century ago the Indians in Minnesota parted with their possessory title to the pine lands to the United States at a low figure. The United States took no pains to ascertain the location, quantity and value of the timber, but from time to time offered it at public sale, with the regulation that after the public sale had continued for so many days the lands unsold could then be purchased at "private entry" at \$1.25 per acre. This looked well on paper, but as a rule purchasers waited till the public sale was over, and then, at \$1.25 per acre, bought lands worth anywhere from \$10 to \$75 or even more per acre.

This system was discontinued about forty years ago, since which time pine lands have been obtained of the United States through the location of scrip; soldiers' additional homesteads (devised not for the benefit of the soldier, but for the benefit of the timber grabber), the homestead law, and the stone and timber act—all and each of which have been but a system of plunder.

The value of the standing pine timber in Minnesota which in the past fifty years has passed from the United States into the possession of private parties has probably not been less than \$200,000,000. Of this a few million dollars worth, originally granted to the state, was given to railroad companies to aid in the construction of their roads.

The records of the U. S. General Land Office, Washington, show that beginning with the year 1849 and up to October, 1897, all that the United States had received for public lands in Minnesota, timber, agricultural or of whatever character, amounted exactly to \$7,286,599.40.

If there are any people who have profited or who in the future hope to profit from plundering the United States of pine lands, or who are the mouthpieces of



Proposed Lake Superior Forest Reserve. Cook and Lake counties together have 2,228,000 acres of land exclusive of water. The forest reserve will occupy only about one-fifth of this area; and consisting of natural forest and mostly third and fourth rate soil. Drawn and engraved for the Annual Report of the Chief Fire Warden of Minnesota.

such people, their influence as opponents of forestry should not have much weight.

At the highest figure, there remains standing in the forests of Minnesota, thirty billion feet of merchantable pine timber, and of the value of \$120,000,000. The most of it is in the hands of private parties, is mature, and will and should be cut as fast as a good market for it can be found; and which will be accomplished in about fifteen years. The most of it will be shipped out of the state. Mature timber is that which has reached its fiscal age—the age when it has ceased to earn good interest by its growth. On average pine soil a pine tree does its fastest growing the first eighty years of its life, and at the end of that period it should be cut.

What is implied then by “forest preservation,” in Minnesota, is the protection from fire of the remaining forests, including the young pine, now all the way from two inches to thirty feet in height, and some of which will be merchantable when the original growth shall have disappeared; the reservation and treatment on forestry principles, either by the United States or by the state of Minnesota, of the few pine lands yet belonging to the United States and which are better adapted to forestry than to agriculture; and, finally, the acquisition by the state by purchase of any land that is too sandy, too hilly or too rocky for agriculture, and holding and using the same for forestry. These three propositions constitute the platform of the friends of forestry in Minnesota.

LAKE SUPERIOR FOREST RESERVE.

An area of about 500,000 acres in Lake and Cook counties that is believed to be better adapted for forest than for any other purpose has been temporarily withdrawn from market with a view of being created as a United States forest reserve, if further examination shall show that it is suitable for that purpose. By the

law of the United States any mature timber in a United States forest reserve may be sold at its appraised value, but not for shipment out of the state in which it is situated. Any person, under the regulations of the Interior department, can enter a forest reserve for all lawful purposes, including that of prospecting, locating and developing the mineral resources thereof; and more than that, can have free use of timber and stone for carrying on his work. Besides, the Interior department may restore to the public domain any public lands in a forest reserve, which, after due personal examination by a competent person, shall be found better for mining or for agricultural purposes than for forest use. The setting apart of lands that are suitable for the purpose as a forest reserve is, therefore, beneficial to the public, though it may not be beneficial to the speculator in timber. Having become satisfied that it would be for the best interest of the public that the above mentioned area be set apart as a forest reserve, I, on the 10th of May last, addressed the following recommendation to the U. S. Commissioner of the General Land Office:

ST. PAUL, MINN., May 10, 1902.

HON. BINGER HERMANN, Commissioner General Land Office,
Washington, D. C.

DEAR SIR: I have the honor hereby to recommend that the following townships, all public land, situated in Cook and Lake counties, in Minnesota, and comprising (after deducting water surface) an area in round numbers of five hundred thousand acres, be set apart by the President as a forest reserve, namely:

Township 59, ranges 5, 8 and 9 west.

Township 60, ranges 4 to 9 west.

Township 61, ranges 5 to 11 west, both inclusive.

Township 62, ranges 5 to 10 west, both inclusive.

Township 63, ranges 5 to 7 west, both inclusive, and south half of township 63, range 8.

Ten of these townships are surveyed and all of the lands are practically vacant, with these exceptions: that only half of township 59, range 9 west, and township 60, range 8 west, are vacant,



From Brule Mountain, looking north, in central part of Cook County. Photographed, by A. B. Herrell September, 1901, for the Annual Report of the Chief Forest Fire Warden of Minnesota.

and that two-thirds of township 60, range 9 west, and township 61, range 5 west, are vacant.

I inclose a map of these lands, with notes showing their character, compiled from the field notes in the United States Surveyor General's office of this state.

I make this recommendation for the following reasons:

1. The land has a general elevation of about 1,200 feet above Lake Superior, is generally hilly and rocky and more valuable for the production of timber than for agriculture. It is natural timber land, but much of the original timber was killed by fires many years ago. Its soil is only third or fourth rate, and the fact that, although fairly accessible, none of it has been taken by settlers, is of itself evidence that it is undesirable for agricultural purposes.

2. The benefit that will accrue to Minnesota by having this waste and vacant land utilized for forestry purposes. Everyone knows that the supply of pine timber in Minnesota is fast diminishing. Already several kinds of lumber from the Pacific coast are competing here with our home products; and, as our home supply decreases, the price of lumber from the coast will be advanced. Dearthness of lumber will tend to retard the development of agricultural lands, farmers being among the principal consumers of lumber. On this land proposed to be created a forest reserve, it will require about eighty years for pine timber to grow to merchantable size. The population of the United States in eighty years from now, according to the estimate of the most competent judges, based on our past history, will be 320,000,000. Everyone can see that the demand for lumber will then be very much greater than at present.

3. The land in question contains many fine lakes and streams, and will, if administered as a forest reserve, prove valuable also as a fish and game preserve.

4. The educational effect of such a reserve would be useful in promoting forest economy in this state.

5. I have been reflecting upon this matter for over a year. I have also seen occasional expressions in the public press favoring a forest reserve to include some of the highlands north of Lake Superior. I have examined the Government plats of all the surveyed lands in Minnesota north of Lake Superior, and those herein contained are about the only lands that are available from being vacant. This is the only opportunity (outside of Indian reservations) of securing a number of townships in a body in this state for a forest reserve. Of course it is understood that the

state of Minnesota is entitled to sections 16 and 36 in each township as school lands; also that the state will have a right to any swamp lands there may be in either township. Also, should any of the reserve be found to be good agricultural land, I, for one, would expect that the law would be made to permit, if it does not now permit, the use of such lands for agricultural purposes. I do not expect the reserve to be a wilderness, nor to shut out any necessary means of communication.

Very truly yours,

C. C. ANDREWS,

Chief (Forest) Fire Warden.

THE COMMISSIONER'S REPLY.

Under date of June 30, 1902, the Commissioner of the General Land Office sent me the following favorable reply, informing me of the temporary withdrawal of lands substantially in accordance with my recommendation for a reserve, which he has designated as the "Lake Superior Forest Reserve, Minnesota."

DEPARTMENT OF THE INTERIOR, General Land Office, }
Washington, D. C., June 30, 1902. }

PROPOSED LAKE SUPERIOR FOREST RESERVE, MINNESOTA.

MR. C. C. ANDREWS, Chief Fire Warden, St. Paul, Minnesota.

SIR: Referring to your letter of May 10, 1902, recommending the establishment of a forest reserve, to include certain lands in Lake and Cook counties, Minnesota, I have to advise you that the matter has been favorably reported to the Honorable Secretary of the Interior by me, and also by the Director of the United States Geological Survey, and the Honorable Secretary has directed me to make temporary withdrawal of lands substantially in accordance with your recommendation.

On account of the extensive adverse holdings thereon, certain portions of the lands mentioned by you may not well be included within the reserve.

Very respectfully,

BINGER HERMANN,

Commissioner.

As soon as practicable, the lands in the proposed reserve will be examined by the United States Geological Survey.

FOREST RECONNAISSANCE OF WISCONSIN.

Wisconsin's Forest Commission, six years ago, employed Mr. Filibert Roth, an able and experienced forest expert, to make a reconnaissance of the northern part of that state, with a view to inaugurating a forest policy. In 27 counties, having an aggregate area of 18,500,000 acres, he found 6,800,000 acres, being 37.2 per cent, of poor land which, he states in his report (published by the Geological and Natural History Survey of Wisconsin), "is either not at all suited to farming, or only doubtfully so, and should by all means be left to forest." He says that his classification, when submitted to revision by the best informants, was generally considered a fair estimate. He found that the original stand of pine had comprised about 130 billion feet, of which 86 billion feet had been cut since 1840; that 26 billion feet had probably been wasted, chiefly destroyed by fire, and that 17.4 billion feet remained standing, and which was being cut at the rate of 3 billion feet per year. He found many thickets of young pine, in the aggregate 200,000 acres, which had sprung up in the previous 25 years, and which he estimated would within fifty years, yield 5,000 feet per acre of merchantable timber. He reports that Wisconsin's home consumption of lumber is 600 million feet a year; that the industries exploiting her forest resources paid yearly to over 55,000 men the sum of over 15 million dollars in wages; and he states in conclusion, that the failure to protect or restock the denuded waste lands "causes a continuous and ever growing loss to the commonwealth, which at present amounts to about 800 million feet per year of useful and much needed material."

"To remedy this matter," he says, "and stop the great loss, it will be necessary to adopt active measures both to protect and restock."

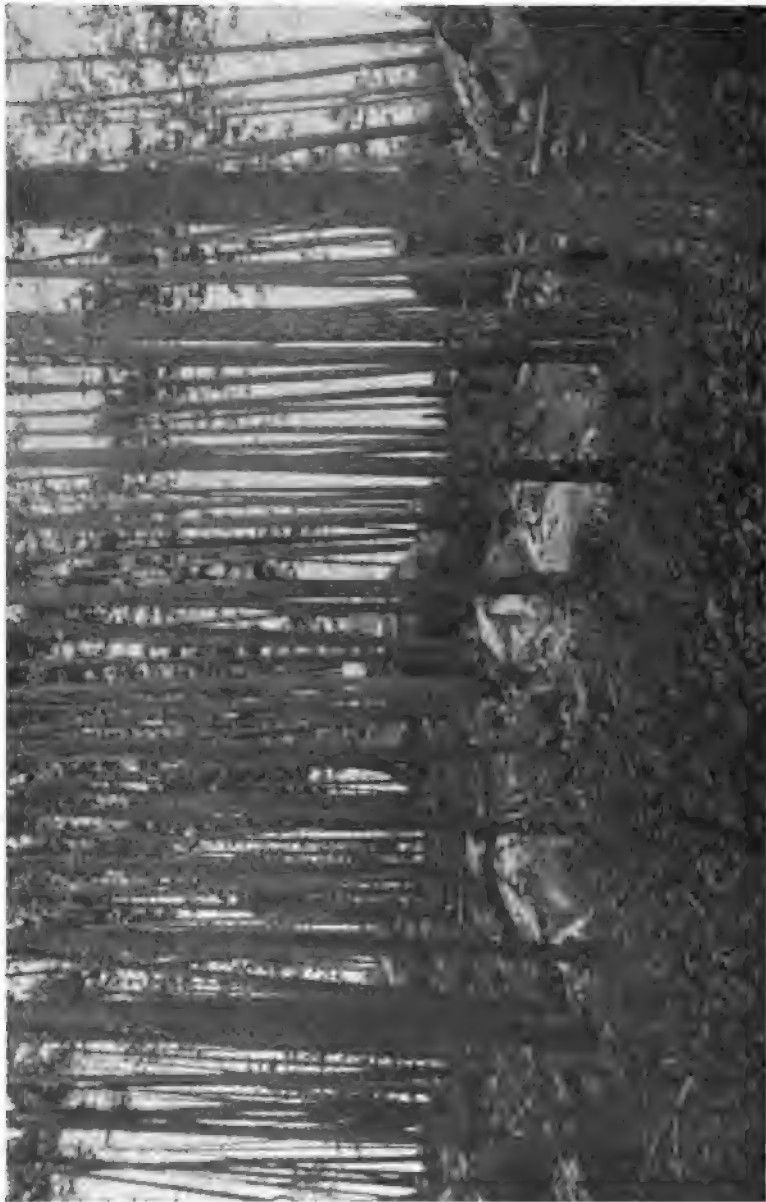
MINNESOTA SHOULD TAKE THE LESSON HOME.

As the forest conditions of Minnesota are similar to those of Wisconsin, except that there are in our state probably 25 billion feet of pine still standing, Mr. Roth's testimony ought to have great value for the people of Minnesota. It is a striking fact that the area originally covered with pine in Minnesota—with, of course, intervening stretches of mixed timber, swamps and bare tracts—was just about the same as that of Wisconsin, eighteen million acres.

The fact that we have in this state 15,000,000 acres of good agricultural land that is not yet under cultivation and that cheap lumber will promote its development; that our population increases 18 per cent each decade; that the demand for lumber will increase; that its value has risen 25 per cent in the last twenty years; that our home supply of original pine timber will, in a few years, be exhausted; that much lumber is already being brought into this state from the Pacific coast at the rate of 130 car loads per day, and the cost of transportation for which averages \$13.50 per 1000 feet, board measure; that centuries of experience of European states instruct and warn us—it is clear beyond any doubt that the sooner we begin in a systematic way to reforest our waste lands the better it will be for the welfare of the state.

It requires 80 years for pine to grow to merchantable size on poor, sandy land. Individuals cannot wait so long for a crop. The state must undertake the work.

The United States still holds 3,000,000 acres of vacant land in Minnesota, of which probably 1,000,000 acres are refuse land only fit for bearing forest; and as soon as our state shows by actual example its willingness and ability to carry on the work of reforesting such land, very likely our delegation in Congress would be able to procure a grant to our state of all such refuse land, for forestry purposes.



Norway pine forest, on rocky non-agricultural land north of Vermillion Lake, on road leading to Rainy Lake. Photographed by A. B. Herrell September, 1901, for the Annual Report of the Chief Forest Fire Warden of Minnesota.

WOMEN'S CLUBS AND FORESTRY.

Forestry made great strides in Pennsylvania because the women in that state interested themselves in the subject. Women ought to do the same in Minnesota. It is relatively a greater subject in Minnesota than it is in Pennsylvania, because Minnesota has more extensive natural forest resources. Women's clubs should not be content to study history; they should make history. Forestry in Minnesota is on its hands and knees, and it is a patriotic duty of the women of the state to place it on its feet.

FORESTRY EXPLAINED.

But before people can intelligently work for a cause they must take the trouble to inform themselves of its principles.

While forestry itself is the science of obtaining revenue by raising trees on refuse land, there are a number of things about the forest in which the people as a whole have a sort of ownership and a decided interest. For example, if sandy hills are well wooded, they make the landscape attractive; but if they become denuded and are left a bare waste, as is the practice in the absence of forestry methods, the scenery loses all its beauty. On such land forestry would have a young growth of timber started before removing all the mature trees. So, when fire is allowed to devastate a forest, especially along routes of travel, the public is robbed of beautiful scenery. Where forestry has its rights, fire is prevented from working such evil. The public has an ownership in water-courses, for they not only beautify scenery, but they fertilize the soil, furnish water for sanitary purposes, and afford means of water-power and navigation. The forest, holding back, as it does, in its porous soil, much of the rainfall, is a natural reservoir of moisture, feeding numberless little springs and rivulets and maintaining water supply in rivers. Forestry forbids the total clearing of

land at the head waters of streams; and the state, though it has not exercised the power, possesses the constitutional authority, as a police regulation, to prohibit a private owner from cutting trees less than eight inches in diameter, breast high, at the sources of our principal streams.

Scenery and water ! Just for these two things alone the public has reason to concern itself with forestry.

Climate is an additional ground for public interest in forestry. Air in the forest is a little warmer in winter and a little cooler in summer than the air of open country. Forest air, like that of the sea, is richer in ozone, and therefore healthier, than the air of open country, and especially than the air of cities. The forest is a barrier to the hot wind from the south and to the cold wind from the north.

The public has rights in the forest for means of recreation. Mrs. Browning, the greatest of woman poets in the English language, wrote in a letter from Italy: "In the deep of the pine forests, which have such a strange dialect in the silence they speak with." It was not for the value of the timber that the state of New York paid a million dollars for 250,000 acres in the Adirondacks, but because tired people love to visit the woods for recreation and rest. When woods are managed according to forestry they are provided with good roads, and are delightful resorts.

The forest, properly managed, is a covert for useful game.

It is largely on account of these collateral benefits from forests that the public is interested and should, wherever possible, demand that they be administered on forestry principles. At present, however, most of the timber lands in this state are the property of private individuals and corporations who will, and for their financial safety must, cut and remove the timber therefrom as rapidly as they can find a good market for it, and without taking any

steps for the reproduction of timber on the cleared tracts. The present owners would not be alive when a new crop of pine forest had matured on the tracts now being cleared. Thus it is that the original pine forests in Minnesota are being cut without regard to forestry principles.

There are many extensive areas in northern Minnesota where pine timber is found growing in the midst of large leaved or hardwood forest. In all such cases the soil will be found sufficiently fertile to be useful for agriculture after the timber is removed. Such land ought to be used for agriculture, for the reason that it will yield a larger revenue in that way than it would in forest. But a large part of the pine lands in the state consist of soil that is too light for profitable use in agriculture, and such lands ought to be purchased by the state and administered on forestry principles.

LEADING PRINCIPLES.

The leading principles of forestry are these: Forest should occupy only non-agricultural land—land that is too hilly, or too rocky, or too sandy for profitable cultivation in field crops. The significance of forestry is that such refuse land used for coniferous forest will yield an average annual net revenue, on the capital it represents, of about three per cent. And when one sees, as he surely will in his travels, an abundance of such land lying waste, and even deteriorating year by year, let him call to mind the revenue it would yield if devoted to forest, and how much handsomer the country would be if all such land were so used.

Another principle of forestry is that the forest, when young, should be crowded to promote height growth. The elements in the air supply the principal food of the pine. The trees must have air and light. In a crowded state they strive upwards for air and light. They shed their limbs naturally when crowded. The weaker trees die out, and the survivors develop, in course of eighty

years, or more, the clear boles for a great height, which yield the best lumber. A pine on open ground produces too many limbs. It may be picturesque, but is not good for timber.

Another principle is that the forest must be administered so as to furnish a sustained yield. It must be perpetual. The cutting of mature trees must be done in a way to promote natural regeneration by seed.

Last, but not least, forest fires must be prevented; for without this there can be no such thing as forestry.

EXAMPLES FROM ABROAD.

The principles of forestry are the same everywhere, but the revenue from forests is naturally greater in Europe than it would be in this country, by reason of denser population, cheaper labor and higher value of forest products.

For example, Bavaria has 2,150,000 acres of state forest, 77 per cent of which is coniferous, yielding a net annual revenue of \$3,222,145, or \$1.50 per acre.

France (exclusive of the colonies) has 23,000,000 acres of forest, of which only 2,700,000 acres are state forest. Of the latter, 600,000 acres are "protective" forests—situated on mountains to prevent land slides, and on the sand dunes of the ocean to prevent the sand from drifting into the interior and submerging good land. The net annual revenue from the 2,100,000 acres of productive state forest is \$1.91 per acre.

France expends \$600,000 a year for scientific forestry in her province of Algeria. It is such things that make a country truly great.

There are in the whole kingdom of Prussia 21,000,000 acres of forest, of which 6,000,000 acres are state forests yielding a net annual revenue of \$9,000,000, being at the rate of \$1.50 per acre, and more than the average American farmer clears from his field crops.

Alsace-Lorraine, with an area of only one-fifteenth that of Minnesota, has 338,500 acres of state forest yielding an annual average net profit of \$2.50 per acre.

The Duchy of Baden, not as large as Pine county in this state, from its 240,000 acres of state forest, derives a net annual revenue of \$667,000, or \$2.50 per acre.

The Kingdom of Wurtemberg, only a very little larger than our county of St. Louis, derives a net annual revenue of \$1,700,000 from its 418,000 acres of state forest, or \$4.00 per acre.

The Kingdom of Saxony, from its 432,000 acres of state forest, mostly on poor mountainous land, derives a net annual revenue of \$1,946,000, being at the rate of \$4.50 per acre.

The forest profits in all these countries, and especially in Saxony, are owing to the density of population, cheapness of labor, high price of lumber and facilities of getting it to market. The forests are not only profitable in a money sense, but they furnish many indirect benefits, including water supply. They are provided with good roads, are well guarded, are delightful resorts, and are no impediment to the cultivation of neighboring agricultural lands.

PROGRESS IN FORESTRY.

In the past ten years the United States government has established sixty million acres of forest reserves, on mostly mountainous land, under a partially equipped force of rangers and guards. A division of forestry, under a forest expert, to administer these reserves, has been created in the Department of the Interior. The bureau of forestry, in the Department of Agriculture, now expends about \$50,000 annually in useful work, and last year made forestry investigations, not only in the national reserves, but in as many as twenty different states, at the request of the respective state governments; also made forest working plans for over a million acres. In this

work many trained and partly trained young American foresters, including some from this state, who are making a good record, took part.

The college of forestry at Cornell University and the school of forestry at Yale University are recent, well endowed and notable institutions.

A new school of forestry has been provided in the University of Michigan, and will commence work next September. Its principal professor will be Mr. Filibert Roth, a well known forester, who has served several years in the United States forestry bureau, also as chief of the division of forestry in the Department of the Interior. His duties as professor will be to foster forestry in Michigan by advice and addresses as well as by actual help in the woods; assist in the care of state forest lands; manage the university forest lands; and educate men in forest work. He will be assisted by Mr. Charles A. Davis, who has served as professor of sciences, in Alma College, Alma, Mich., and who has had extensive experience as a woodsman.

Of other schools where forestry training is given, that at St. Anthony Park, Minn., and that at Biltmore, N. C., are not the least.

Of the different states, two or three have already adopted, and a dozen or more are trying to work out, plans of forest restoration and administration. The State of New York has expended about \$2,000,000 in purchasing land, in the Adirondack mountains, for forestry purposes. She has contributed much to forestry literature. Her constitution, however, prohibits the cutting of any timber in the state forests, and requires them to remain in their natural state. This, the friends of forestry wish abrogated, and, when done, New York will be in the lead, if she is not now, of all the states in forestry. Pennsylvania has lately authorized its forest commission to buy any land suitable for forest at not exceeding \$5 per acre, and her commissioner states that during the term of the



Food for forest fires. Sample of country on the White Earth Chippewa Indian Reservation where the United States Government lumbered for the Indians a few years ago in a splendid forest of Norway pine. Shows a lack of forestry methods. Photographed, April, 1901, for the annual Report of the Chief Fire Warden of Minnesota.



Private forest of spruce and fir in Germany. Light cutting just made of largest trees. A "Selection forest," in which the large trees are cut and the smaller ones left to grow. Engraved for the Annual Report of the Chief Fire Warden of Minnesota.

present governor, who is much interested in the question, half a million acres will have been acquired for such purpose. In Michigan about 200,000 acres of land have been set apart for forestry purposes.

The legislature of Minnesota enacted the following law, which was approved April 8, 1903:

The Minnesota state forestry board is hereby authorized to acquire by purchase for the state at not exceeding two dollars and fifty cents (\$2.50) per acre, and preferably at the sources of rivers, any land in this state that is adapted for forestry, but not to exceed in any one congressional township, one-eighth part of the area of such township, and to take such steps as are necessary to maintain forest thereon according to forestry principles. One-quarter part of the net forest revenue from such lands shall always be paid to the respective towns in which the lands are situated. No money shall be paid by the state for any such land until the attorney general shall certify that the deed thereof conveys a clear title in the state.

No appropriation was made to carry this law into effect, and for the reason probably that \$20,000 was appropriated for the purchase of additional land in the original limits of the Itasca state park. The state now has a thousand acres of cut-over pine land in Cass county, donated by the late ex-governor John S. Pillsbury, and for which a preliminary working plan, after survey, was made last summer. A bulletin on the same was issued by the Forestry Board. Notice of expiration of redemption period has been served in respect of about a thousand acres in Cook county, which the board also expects to obtain for forestry purposes, under chapter 335 of the laws of 1901. If these are but crumbs, they foreshadow better things.

One of the results of forestry agitation in Minnesota was the recent act of Congress for opening the Chippewa reservation, creating a forest reserve of 200,000 acres, and which secures to the Indian, for the first time in his history, the true value of his timber.

EUROPEAN FORESTRY.

No intelligent friend of forestry supposes that the science of forestry will, for a long time, produce in this country the results which are seen in many of the densely peopled states of Europe, but a knowledge of these splendid results is very instructive and stimulating, and for that reason I have taken pains to diffuse such information. The science of forestry is the same everywhere, but its application depends upon the conditions which are found in different countries. Let us assume that there is a natural coniferous forest on non-agricultural land in Germany in which 75 per cent of the trees are mature and 25 per cent have not reached merchantable size. According to scientific forestry the 75 per cent of mature trees will be cut just as soon as the market would justify and the 25 per cent of trees of unmerchantable size would be left to grow till they should be fit to cut. A similar natural forest in this country would be treated in the same way, if treated according to forestry principles; and some lumbermen, such as those, for example, who hold pine lands in the valley of the St. Croix river or on its tributaries in this state, and who have gone back every fifteen or twenty years to make a second, third or fourth cutting on the same land, are managing their forests in this way. In cases where pine lands are remote from streams of capacity for floating and where the pine is reached by temporary logging railroads, clean cutting is made of both large and small trees; but lumbering of this latter description is in violation of forestry principles. If a trained forester were to commence cutting a mature forest he would not begin on that side of it which is exposed to the prevailing wind, because if

he did every cutting would freshly expose the remaining forest on the side of the cutting to dangers from the wind. Instead of that he would begin on the side opposite the prevailing wind, leaving the forest border, long years hardened to the wind on the windward side, as a protection to the forest. Now, that is a principle of scientific forestry and is just as applicable in this country as in Europe. Again, a trained forester in Germany would manage the cutting so as to promote natural seeding from the nearest trees left standing, and that principle is just as applicable in this country as in Europe. If a person in this country were to begin to manage a natural forest on forestry principles he would first have it surveyed; he would ascertain the number, contents and situation of the mature trees; he would gradually make necessary roads; he would make a map of his forest and prepare working plans for its administration and ascertain where he could sell the mature trees at the highest price; these would be the essentials that he would perform, and he would be doing just the same as a German forester would do with a forest in Germany. Owing to the denser population, cheaper wages, better roads, and very much higher value of land and forest products, the results of forestry are very much different there from what they are in this country, or will be for many years. But the cause of forestry in this country will be greatly promoted by diffusing a knowledge of European forestry; and for that reason I reprint from my last report sketches—obtained at great pains and in many instances direct from the respective governments—of the forests and forestry of several European states. A few sketches have been slightly abridged.

ALSACE-LORRAINE.

STATE FORESTS.

Aggregate extent, 338,500 acres, situated in the valleys of the Rhine and Mosel rivers and on the Vosges moun-

tains. The prevailing kinds of trees are fir (*abies pectinata*), spruce (*picea excelsa*), pine (*pinus sylvestris*), oak and beech. The average estimated value per acre is about \$100. Annual aggregate expense of administration, \$862,000; annual aggregate revenue, \$1,712,000; average net profit per acre, \$2.50. The number of acres annually sown with seeds, 610; planted with seedlings, 1,250 acres. On 2,750 acres the surface of the ground is roughly opened with spade, plow, harrow or hoe with a view to facilitate the germination of self-sown seeds. On about 50 per cent of the entire area, reforestation is effected by self-sown seed from standing trees; on about 35 per cent of the entire area planting trees, and on about 15 per cent planting seeds is resorted to.

There is a continuity of forest produce. The annual yield or cutting of the forest is not allowed to exceed the annual production. A decrease of the growing stock, by over cutting the forest, would be considered a criminal offense on the side of the forest administration. The general increase of the productiveness of the forest, however, permits of a gradually, but slightly, increased annual output. The forests consist of more or less averaged sections termed "compartments." Every compartment yields periodically (say in the 50th, 70th and 90th year of the tree life) a certain "intermediate yield," composed of immature trees, removed by way of thinnings. When the remaining trees reach financial maturity, they are removed either by a clean sweep or gradually, the removal proceeding hand in hand with the development of the second growth started underneath the mature trees (fir and beech).

The cutting of forests, with a view of using the soil for agriculture or pasture thereafter, is strictly prohibited since 1803, unless, under certain stated conditions, permission to the contrary effect is granted by the civil government. Any forest ground cleared from tree growth must be planted up within three years after such clearing, if in the opinion of

the forest administration regeneration from self-sown seeds cannot be depended upon. The owner of unproductive lands, when proposing to plant such lands to forest, receives certain contributions out of the treasury of the state. Plantations made on the tops and on the steep slopes of mountains, also plantations made on dunes and on unproductive prairies densely clothed with ligneous weeds, are free from taxes for 30 years. The amount of damage annually caused by forest fires is very little; no data available. The principal cause of such fires, when they do occur, is the careless use of matches and cigars thrown away burning. Very few such fires are annually caused by railroad locomotives; no data available. It may be estimated that in Alsace-Lorraine, as in Prussia, 10 per cent of all forest fires are caused by sparks from locomotives.

The forest service is entirely co-ordinate and equal to the other branches of the public service. The average salary per annum of the "Land Forst Meister" (forest counselor) is \$2,000; of the "Forst Meister" \$1,500; of the "Oberförster" (district manager) \$830; and the allowance for office and traveling expenses of each officer is \$500. All forest officers have the use of an unfurnished house free of charge.

PRIVATE FORESTS.

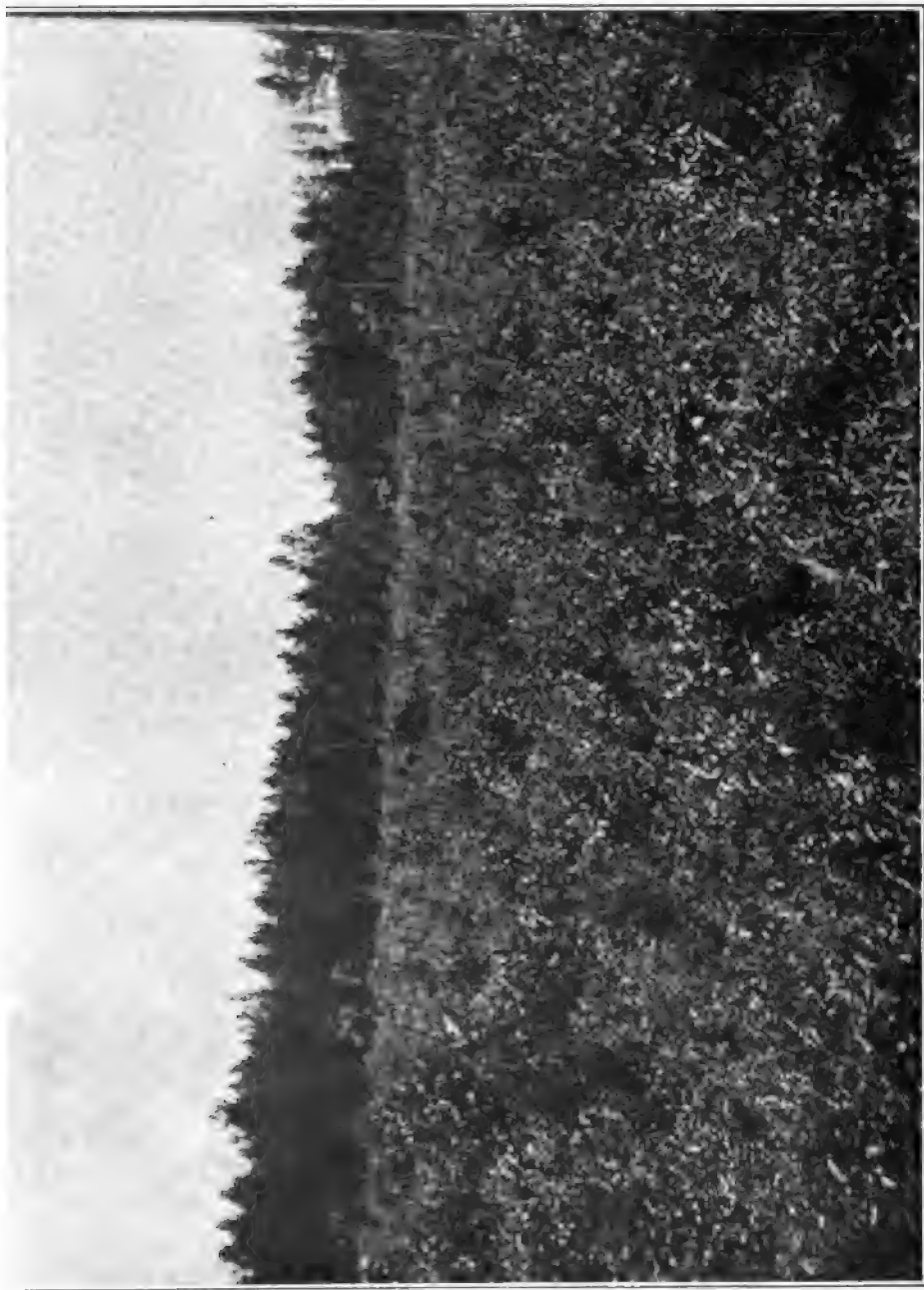
The aggregate extent of private forests is 771,000 acres, of which 546,000 acres are managed on forestry principles, being owned by towns, villages or public institutions. The forests owned by private individuals proper, aggregating 225,000 acres, are managed at the will of the owner except as above stated. The average value per acre is uncertain; it depends on growing stock, accessibility, quality of soil, etc. However, the average value of the private forests may be roughly estimated at \$75 per acre. The average annual rate of net income is between one and one-half and four per cent. The total forest product of Alsace-Lorraine

is well sustained. The municipal forests yield 70 cubic feet per acre per annum. This quantity is equivalent to about 140 feet of lumber, board measure, and one-half a cord of fuel. The population of Alsace-Lorraine is 1,605,000. The area of the entire territory is 3,625,000 acres, of which 1,110,950 acres are under forest. The annual yield of raw material is 61.1½ cubic feet per acre. Of this amount 40 per cent consists of timber, and 60 per cent of fuel, corresponding with about 170 feet timber, board measure, and four-tenths cord of fuel. The cost of cutting timber and fuel, inclusive of sawing into logs, piling along wood roads, etc., amounts to one and one-tenth cents per cubic foot. At this price the workmen earn 43 cents per day. The value of timber, dragged to forest roads, is 9½ cents per cubic foot, on an average. The value of fuel, piled up along roads, is three and four-fifths cents per cubic foot, or about \$3.42 per cord. The stumpage of timber is worth about \$12 per 1,000 feet, board measure. In the state forests about \$80,000 are spent annually for road improvement and forest railroads. The exclusive right of hunting is periodically leased to the highest bidder, under certain restrictions. These leases yield annually about 4 cents per acre. In the season of 1893-94, for instance, there were killed, in certain districts aggregating 320,000 acres, 42 head of red deer, 451 head of roe deer, 175 head of wild boar, 2,555 hares and 24 capercaillies (mountain cock), besides a number of minor animals.

AUSTRIA.

STATE FORESTS.

The entire forest area of Austria is, in round numbers, 24,000,000 acres, of which the state administers 2,573,940 acres of actual forest, and of which 800,000 acres belong to religious, educational or charitable endowments. Under the Department of Forestry there are eight territorial



Young Norway (red) pine in the foreground planted four feet apart on cut over pine land on the State Experiment Farm at Grand Rapids, Itasca County. Photographed July, 1902, for the Annual Report of the Chief Fire Warden of Minnesota.

offices, and under these eight territorial offices there are 186 local offices. The largest area under the supervision of a single territorial officer is 628,225 acres; the smallest area under the supervision of a territorial officer is 191,498 acres, whilst the average is 452,762 acres.

Including unproductive soil a local range comprises in one case as much as 120,726 acres. If only the productive forest area is drawn into calculation, the maximum size of a local range is 58,993 acres, whilst the minimum is only 1,030 acres. The average size of the forest area under the management of a single local officer is 13,880 acres.

There are two distinct groups of forests administered by the state authorities—one in the east, comprising lands in Galizia and Bukowina, and one in the west, comprising the Alps. Besides, there are some smaller forests lying in the southern and the northern sections of the empire.

Twenty-six per cent of the state and fund forests are lying in the plains and at the foot hills.

Forty-nine per cent of them are lying in the mountains, at medium elevations, growing under conditions favorable to tree growth.

Twenty-five per cent of them are lying in the highest mountain region, extending up to the limit of tree growth.

The species covering most ground is the European spruce (*Picea excelsa*), occupying 49 per cent of the entire forest area. Beech is next, occupying 20 per cent. Then follows the fir, occupying 19 per cent, and the larch, occupying 5 per cent. A small area only is in possession of the pines (only 3 per cent). The balance of 4 per cent is occupied by alder, linden, maple, oaks, elms, aspens, willows, etc. It appears from these figures that the Austrian state and fund forests consist of coniferous woods to the amount of three-quarters and of hard woods to the amount of one-quarter.

In the Alps spruce reaches up to an elevation of 2,000 meters (or 6,562 feet), and in the Karpath mountains to

an elevation of 1,500 meters (or 4,921.5 feet). It forms, especially on the high mountain ranges, pure forests in many cases. However, it is often found mixed with other conifers and with hardwoods. In the very highest mountains it shows a poor growth, short boles and bad form, the diameter increasing rapidly from the root to the top. The branches are running down to the ground and are covered with lichens. Spruce thrives best on slightly sloping ground protected from high winds, where the underlying ground is a sandy loam formed from slate. Here the tree shows long, straight and clean boles. However, spruce is found thriving in almost all situations.

Silver fir (*Abies pectinata*) is mostly found mingled with beech, horn-beam and spruce. It does not run as high up in the mountains as the spruce will do. However, it is found in the Karpath mountains at an elevation of over 1,500 meters (or 4,921.5 feet). Pure forests of fir are found only in a few places (Vienna forest, Karpath mountains and Krain).

Larch (*Larix Europæa*) is scarcely ever found forming pure forests. Its favorite ground is an eastern and northern slope where spruce is the predominating species. Under these conditions it rises as high up as 2,200 meters (or 7,218.2 feet). Larch is thriving splendidly on calcareous and sandy loam, especially on well shaded slopes. Larch avoids wet, sunny, and such localities which are exposed to rough winds.

Scotch pine (*Pinus sylvestris*) is found in the Alps and in some dry and poor localities elsewhere. It is running up to an altitude as high as 1,200 meters (or 3,937.7 feet, in southern Tyrol even as high as 1,700 meters (or 5,577.7 feet), here attaining the size of a dwarf only. In the sandy plains of Galizia, Scotch pine shows a good growth and furnishes fine timber.

The black pine (*Pinus Austriaca*) is very scarce on the whole. On the south slopes of the Vienna mountains it

forms small forests. It is fond of the sunny side and of calcareous ground.

It is impossible to ascertain the value per acre of the state and fund forests. This value depends on the locality, on the means of transportation, on the condition of the lumber market, etc. Even an average figure giving an idea of the value of the said forests cannot be given. If the annual net yield per acre is taken as a basis for the valuation of our forests at a rate of 3 per cent, then the average value of the state and fund forests per acre will amount to \$8.91. It is likely to range between \$3.50 and \$20 per acre, according to the possible yield.

During the twenty years between 1874 and 1893 there was expended annually on an average:

I. For forestry proper, namely, forest utilization, transport of forest products, charcoal burning, maintenance of forestry buildings, silviculture, etc.	\$732,578.17
II. For agriculture, namely, expenses for administration and for maintaining buildings.....	9,675.45
III. For other branches, namely, for technological industries, for shooting grounds, fishing, timber yards, etc.	87,193.67
IV. For administration, including the salaries for all local officers, rangers, guards, etc., their traveling expenses, the expense of keeping up buildings used by these officers, etc.	418,499.05
V. For public expenses (taxes and charity expenses).	259,867.44
VI. Money refunded	756.13
VII. Extraordinary expenses (purchase of real estate, new buildings, new surveys, demarkation of boundary lines, forest working plans, prescriptive rights, etc.)	143,845.88
VIII. Administration at headquarters (expenses at the territorial offices and at the ministry of agriculture)	151,340.20
Grand total expense.....	<u>\$1,803,755.89</u>

During the same period—namely, during the twenty years between 1874 and 1893—the mean annual gross receipts amounted to:

I. From forestry (sale of fuel and timber, of charcoal, of minor forest produce, etc.)	\$1,727,805.73
II. From agriculture (rentals from land leased, etc.)	161,592.16
III. Technological industries (rents of buildings and establishments, rents from shooting and fishing licenses, rents from yards, etc.)	291,747.02
IV. Money refunded	6,524.15
V. Extraordinary revenue	19,492.24
Total receipts	<u>\$2,207,161.30</u>

To the latter figures there must be added the value of the prescriptive rights under which the inhabitants of certain villages have the privilege of taking timber, fuel, grass, etc., from the forest without refunding any money for such taking, estimated at.. 290,336.40

Therefore grand total gross receipts.....\$2,497,497.70
Deducting from this amount the expenses previously mentioned, there remains a net revenue of..... \$693,741.81

Thus the entire state and fund forests of the Austrian empire have netted on an average, during the above named period of twenty years, 26.8 cents per acre per year.

During the five years lying between 1887 and 1893 there were planted up annually on an average 15,614 acres, by means of planting seeds or planting seedlings, at an expense of \$28,586.01 for labor only. To these planting expenses there must be added the annual expenses incurred for the following items, namely:

I. For raising, transplanting and nursing plants in nurseries proper	\$17,894.78
II. For preparatory work, as drainage, subsoiling, making mounds to plant upon, etc	1,694.96
III. For cleaning and attending to the young forest previous to the age of, say, 20 years	6,406.72
IV. Spades, picks, mattocks and other tools	834.02

Adding these items to the above named figure of \$28,586.01, the grand total expense for replanting amounts to \$55,416.49, or to \$3.55 per acre.

Of the entire forest area of 2,590,182 acres, six-tenths of one per cent are planted up annually. Of these, 40.5 per cent were planted with seeds and 59.5 per cent were planted with seedling plants. For planting seeds there were used annually 23,669 kilograms of coniferous seeds; further, 561 hectoliters of acorns and 10,543 hectoliters of walnuts. The number of seedlings planted annually averages 17,604,196, planted out on 9,294 acres.

Regeneration is effected partly from self-sown seed under the cover of mother trees, partly from coppice shoots, partly by planting and sowing after clear cuttings as indicated above. Besides, where natural regeneration fails, planting seeds or seedlings takes place. The number of acres either wholly or partly cut over annually is 18,212. Of these, 55 per cent, or 10,108 acres, are planted up artificially by means of sowing and planting, whereas 45 per cent, or 8,104 acres, are regenerated from self-sown seed or from coppice shoots.

The difference between the area planted up annually, namely, 15,614 acres, with the area replanted annually after a clear cutting just mentioned, namely, 10,108 acres, amounts to 5,506 acres, and may be explained partly from the fact that on a considerable fraction of the 8,104 acres just mentioned artificial help is needed when natural regeneration fails, partly from afforestation of areas not occupied by forest crops heretofore.

The total amount of the annual harvest, or annual cut, on the whole area under the state forest management is pretty constant, whilst it is more or less subject to changes in the different territories or forest ranges, according to market conditions. Owing to the system of roads and railroads in the forest of Galizia and of the Bukowina be-

ing extended annually, the annual utilization of forest produce in the state and fund forests is expected to increase in the future. The annual cut depends on figures prescribed by forest-working plans. It is never allowed to surpass the yield capacity of the forest.

Aside from charcoal burning, forest products are sold before manufacturing takes place. The trees to be cut are felled, freed from branches, and cut up into logs, and, if so desired, split up and freed from bark at the expense of the owner of the forest. "Timber" consists of: (1) Timber fit for building purposes which is not cut up into logs; (2) saw logs, the length of which depends more on the conditions of the logs than the inspection rules; (3) "work wood," which means timbers fit for carriage work, for turnery, etc.; (4) split timber, used especially for cooperage purposes. "Fuel" consists of wood for burning and for charcoal making. The former is cut up into pieces one meter (or 3.281 feet) long, the bark not being removed. According to the diameter of the log from which the fuel is taken, it is sold either split or unsplit. It is piled up according to quality, in distinct and separate piles. Fuel for charcoal burning is cut into pieces two or three meters long.

Relative to the reforestation of ground allotted to forestry, the main rules are found in paragraphs 2, 3 and 4 of the imperial "Patent," dated Dec. 3, 1852, which run as follows: Paragraph 2: "Without special permission, no forest ground must be devoted to other purposes than timber production. If forest ground is used for other purposes than timber production, the owner shall be fined 30 cents to \$1.50 per acre. After such unlawful use the ground must be replanted within a time prescribed by the local authorities. If reforestation does not take place within the time thus prescribed a second punishment shall take place." Paragraph 3: "Areas cleared from forests are to be planted

up with timber species within five years after the clear cutting in the case of forests owned by the state or by the communities. Wherever there are clearings left from olden times they must be planted up within a period equal to the time fixed for the rotation of crops or fixed as the age of maturity of trees. In the case of private forests, a longer space may be allowed according to circumstances. Whosoever neglects this prescription shall be punished in the same way as if he had used forest ground for other purposes than for timber production." Paragraph 4: "No forest must be devastated; i. e., it must not be treated in such a way as might endanger or render impossible the continuation of timber production. If there is such danger, the fine to be imposed upon the owner of the land shall be the same as if forest ground was used for other purposes than timber production, or as if afforestation was omitted after a clear cutting. Aside from the fine, afforestation shall be made by force, if necessary, the owner bearing the expenses."

If the treatment was such as to render timber production impossible for the future, a fine up to \$3 per acre shall be imposed upon the owner. Under these rules or laws the local authorities have planted up during the years 1891 to 1895:

In state and fund forests, 231 acres; in communal forests, 28,269 acres; in private forests, 126,949 acres.

Preventives against forest devastation were taken:

In state and fund forests, on 1,393 acres; in communal forests, on 328,487 acres; in private forests, on 1,003,342 acres.

The statistics for the years 1891 to 1895 show that there occurred 3,007 forest fires, running over an area of 19,310 acres, and causing a loss of \$163,904. On the yearly average, 601 forest fires have run over an area of 3,862 acres, involving \$32,781 damage.

These fires were caused: By carelessness, in 1,210 cases; intentionally, in 181 cases; by sparks from locomotives, in 118 cases; by lightning, in 26 cases; by unknown agents, in 1,472 cases.

The officers of the state forest administration have a general rank equal to all technical branches of government administration. The forest officers in Austria are divided into two groups, one of which is attending to the administration of the Austrian state and fund forests, while the other is charged with the control and enforcement of all laws and rules enacted with reference to forestry. The latter forest officers are joined to the local political administration.

All government officers are allotted to different grades or ranks, the rank depending on their merit and their age, and being combined with a certain title and with a definite income peculiar to that rank. Forest officers are found in the following ranks: Tenth rank, forest assistants engaged in the administration of state and fund forests, drawing a salary of \$364 to \$405 per annum, to which there must be added an additional pay varying from \$64 to \$162, according to the time which the officer has spent in government service; ninth rank, head foresters entrusted with the local administration, drawing a salary of \$445 to \$526, with an additional pay varying from \$81 to \$202; eighth rank, a forest master, or inspecting officer, draws a salary of \$567 up to \$729 and an addition from \$97 to \$243; seventh rank, a forest counselor draws a salary of from \$810 to \$972 and an additional pay of from \$142 to \$283; sixth rank, a superior forest counselor draws a salary of from \$1,134 to \$1,458, in addition to a pay of from \$162 to \$324, depending on time of service. The traveling expenses, daily allowances on journeys, etc., differ according to the rank of the officer. Many of the local officers are living in government build-

ings, paying a rent equal to one-half of the additional pay above mentioned.

PRIVATE FORESTS.

At the close of 1895 the entire forest area of Austria was 23,993,442 acres. Deducting from this figure the area of the state and fund forests, aggregating 3,782,369 acres (out of which 862,236 were unproductive area), there remain 20,211,072 acres, which are composed of communal forests to the extent of 3,456,782 acres, and private forests to the extent of 16,754,290 acres.

There are treated according to forestry principles proper: In the case of communal forests, 14.5 per cent, equal to 500,818 acres; in the case of private forests, 38.4 per cent, equal to 6,434,070 acres. In these forests all work is done according to working plans, periodically made by officers of a training equal to that of the government forestry officers. In 85.6 per cent of the communal forests (2,955,964 acres) and in 61.6 per cent of the private forests (10,320,220 acres) no working plans exist. The work is done without reference to scientific forestry, more or less at haphazard after empirical rules.

The price of private forests depends on the quality of the soil, the age of the forest, and on the locality, viz., on the market conditions and on the industrial development of the section in which the forest is situated. Thus it is impossible to give even an approximately correct figure representing the value of private forests. Forest land has been sold actually at prices ranging between \$5 and \$340.

The annual net revenue drawn from forestry varies just as much as the value of the forest itself. It is impossible to give any exact figure showing the annual net revenue from private or communal forests. A net revenue of equal to two or three per cent of the capital invested in forestry may represent a fair average.

The annual production of timber and fuel in the Austrian forests has somewhat declined of late. Savings are made everywhere to make good former over-cutting. Besides, the regulations of the forest laws are now being enforced, and under these enforced laws the utilization of forest produce had to be diminished. In the year 1890 the total harvest of timber and fuel from 24,173,333 acres of forest aggregated 29,341,590 cubic meters, or 1,035,758,127 cubic feet. In the year 1895, on the other hand, there were cut from 23,993,442 acres only 27,523,241 cubic meters, or 971,570,407.3 cubic feet.

It may be stated that the smaller figures, representing the area of the forest in 1895, are explained by the fact that the political authorities, whenever they think it fit, after consulting the foresters in charge, approve of a change of forest land into agricultural or pasture land. Besides, the diminished area is partly explained by mistakes made formerly in the survey of the forests.

DUCHY OF BADEN.

STATE FORESTS.

The aggregate extent of the state forests of Baden is 240,304 acres, located in the Black Forest and the upper valley of the Rhine. The prevailing kind of trees is coniferous. The beech, however, covers the largest surface; next follows the fir, then the silver fir and the Scotch fir. The average estimated value per acre, taking the average of the ten years, 1886-1895, is \$98.55. The annual aggregate expense of administration is \$568,078. The annual aggregate revenue amounts to \$1,235,332, and the net revenue is \$667,244. Number of acres annually sown to forest is 222, and the number of acres planted is 823. Reforesting is effected by seed from standing trees; also by planting trees; in some rare cases



Along the first sixteen miles of the Duluth, Virginia & Rainy Lake R. R., taken Sept. 24, 1902. Non-agricultural land, but will produce timber. Land better adapted for forest than for agriculture.



Pine forest on Duluth, Virginia & Rainy Lake R. R., ten miles north of Virginia. Snapshot Sept. 24, 1902.

by artificial sowing, the latter in the case of firs. There is a gradual increase of crop. The usual method of cutting the crop consists in cutting the mature trees and covers at periods, as a rule, from thirty to forty years, with longer or shorter intervals. Cutting in blocks clean (pines and Scotch firs) in exposed stormy situations is less frequent. According to paragraph 29 of the forest law of Baden of the year 1879, no part of any forest is allowed to be kept uncultivated. The number of forest fires during the years 1879-1888 was 61, the damaged surface 99 acres, and the damages amounted to \$2,225. The principal causes of such fires are negligence, when burning down the skirts of the forest, or by throwing away matches or stubs of cigars. Very few cases of fires are caused by railroad locomotives.

The forest service ranks equally with other branches of the public service, and is comprised in Class D of the tariff of salaries. Seven members of the Administration of Domains (which forms a part of the Treasury Department) are the highest forest officers. They bear the title of Councillors of the Forest Board, and have a salary not exceeding \$1,380, and \$147 compensation for rent.

Besides the state forest there are community and corporation forests, covering a total surface of 555,069 acres, which are managed on the same principles as the state forests.

PRIVATE FORESTS.

The aggregate extent of the private forests is 451,670 acres. About one-third of all private forests is managed on forestry principles, including the forests of the Public Administration of Street, River and Railway Construction, and the most extensive and important private proprietors. The total forest product of the country increases gradually.

BAVARIA.

STATE FORESTS.

Bavaria, whose attractive capital, Munich, is frequented by so many Americans, has 6,000,000 inhabitants. Its state forests comprise 2,150,000 acres, and are mostly managed as "selection" forests. Large forests are to be found in all parts of the kingdom; but as a general rule the mountainous districts in the south (Alps), the north (Spessart) and northeast (Bohemian forest) are covered with the densest forest. Of the whole area of the country 33 per cent is covered with forest. The prevailing kind of trees, or 77 per cent, are coniferous. The remainder comprise various kinds of deciduous trees—those losing their foliage in winter. Among the conifers, red and white pine are most frequent. Among the deciduous trees the beech occupies the greatest space. The oak is also cultivated quite extensively for tanning purposes. The average estimated value of the forest land is \$50 per acre. The annual aggregate expense of administering the forests (1891) including salaries of officials, wages of workingmen, local taxation, new purchases, etc., amounts to \$4,965,204. The total revenue from the forests the same year amounted to \$8,187,349. Number of acres sown or planted to forests in 1892 was 14,800, more than three-fourths of which area was planted with coniferous trees. In the case of the red pine and the white pine, reforestation is mainly done in the natural way. In the case of the fir (*pinus sylvestris*) it is always effected artificially; in the case of the beech, always in a natural way (seed from standing trees); in the case of the oak, generally by artificial sowing. There is a continuity of forest products and a steady increase of the revenue which the state derives from its forests. This is due, first to an increase of prices, secondly to an increase of the yearly

crop. The latter must chiefly be regarded as a result of the present condition of the forests, which are being and have been steadily improved; also of the economy which was practiced in former times. Where reforestation is effected by seeding from the standing trees, the crop is generally cut in lengthy strips, usually not exceeding about thirty yards in width. As a general rule the administration of the state forests makes it a principle to avoid cutting in large blocks clean. In regard to compulsory tree planting, it may be said that every forest area, the trees of which have been cut, no matter whether state or private property, must be reforested in a short time, unless evidence can be furnished that the land would be better adapted to agricultural purposes.

The damage caused by forest fires is quite insignificant, being in 1890 only \$974, in 1894 only \$1,686. The principal cause of such fires is the carelessness of the workmen employed in the forests and of individuals and parties making excursions, particularly on Sundays. There are no data at hand as to the number of such fires caused by railroad locomotives, and although some fires are no doubt so caused, the number is certainly very small.

The administration of the Bavarian state forests constitutes one of the departments of the ministry of finance. It is directly subordinate and responsible to the latter, no other authorities intervening. The highest forest official who may be regarded as being at the head of the forest administration, responsible, of course, as stated, to the minister of finance, bears the title "Ministerialrath,"—ministerial or cabinet councilor. The chief director of the Bavarian administration of state forests is "Ministerialrath" Ganghofer. His starting salary is 7,740 marks. After a sixteen years' service the salary advances to 8,820 marks. Next in rank are the so-called "Oberforstrathe," with a starting salary of 6,660 marks, which, after a sixteen years' service, is increased to 7,740 marks.

PRIVATE FORESTS.

The aggregate extent of private forests was 3,149,400 acres in 1892. In addition to the state and private forests there are about 800,000 acres of forests belonging to separate towns and villages. The forests which are owned by great landholders are managed on forestry principles. These forests, however, only comprise a very limited area, somewhat less than 400,000 acres. Most of the private forests are the property of small landholders. The average value per acre of private forests is somewhat less than that of the state forests. The net income rate varies widely. The data at hand are too few and too unreliable to admit of arriving at any conclusion with regard to the average. Opinions vary as to whether the total forest product of the country increases or decreases. In general the extent of the private forests seems to be somewhat decreasing. This would, of course, also appear to entail a decrease of the total forest product. Forest lands are only allowed to be changed into agricultural lands when proof can be furnished that the agricultural crop may be expected to exceed in value the forest crop. Between 1886 and 1891 7,000 to 8,000 acres of private forests were newly planted or sown.

DENMARK.

STATE FORESTS.

The experience of a country which had adopted important forestry regulations almost at the very beginning of the last century and which has successfully, through tree planting, resisted the invasion of desolating sand drifts from the sea shore must prove of much value. It was, therefore, with a high degree of satisfaction that I lately received from the Department of Agriculture of

Denmark, answers kindly furnished in the English language to some questions that I had submitted. I have put the information in its present form.

The aggregate extent of the state forests of Denmark is 142,140 acres, besides 2,962 acres for public parks. Of these, 67,700 acres are old forests, 74,440 acres are new plantations, especially on heathy tracts. The planting of forests had already commenced one hundred years ago, but has quite particularly increased since 1850. Forty-five per cent of the state forests are situated on the Danish islands; 54 per cent on the peninsula of Jutland, of which latter only 10.6 per cent are old forests, the rest are new heath plantations not yet thoroughly planted up. Beech comprises 37.7 per cent, oak 3.3, ash, maple, birch, elm and alder 4.8 per cent, and conifers 54.2 per cent. Conifers did not exist in Denmark 150 years ago, so that the extensive area of conifers in the state forests at present has been produced artificially. For the planting up of heaths the mountain pine (*pinus montana*) and the spruce (*picea excelsa*) are particularly utilized. The annual aggregate expense of administration averaged \$40,000 per year for the period 1893-97. Annual aggregate revenue averaged per year for the period 1893-97: revenue \$258,416, expenses \$195,370. The smallness of the net revenue arises partly from the fact that about half of the state forests are still so young as to yield only a small revenue, partly from extensive new areas being cultivated every year. The area annually sown or planted to forest averaged 2,285 acres per year for the period 1897-1900. Regeneration from self-sown seed is only used in the case of the beech (*fagus silvatica*) and of the silver fir (*abies pectinata*). In all other cases, forests are regenerated by means of planting plants or sowing seeds.

There is a sustained yield. Every tenth year a working plan is prepared for cuttings and cultivations of the next decennium. In working out these plans it is taken

into consideration, as far as may be, that there should be such areas and stocks of wood in store for the future as are available for the decennium. Within such a decennial period the yield of the cuttings varies according to circumstances; as a rule, however, there is but little differing one from the other. The extent of the state forests being on the increase, the proceeds will naturally increase. The forests are divided into parts of 10—100 acres in size, according to the nature of the soil or the species and age of the stock of wood. Within each decennial period a certain number of such divisions are destined for cutting, and the latter is commonly to be finished and the areas restocked with plants at the end of the period.

Private persons are prohibited by the law of September 27, 1805, from cutting away those remnants of the old forests of the country still existing in the said year. In cases of offence, means are placed in the hands of the government to force the owners to restock the cleared area under control of the state officer in charge. Consequently but very few forest areas have disappeared in the course of the nineteenth century. The many new plantations in Jutland which have risen by means of government subventions disbursed through the "Hedeselskabet," are subject to the same prohibition of clearing. Finally, under the guidance of a board of administration not appertaining to the state forestry service, the government has caused the waste sandy downs on the west coast of Jutland to be planted in order to subdue the sand drift in those parts, which had in former times caused great devastation. At the close of 1899 about 27,000 acres of sand downs had been planted with a good result. Damages by forest fires occur every year, but they have hitherto been rather insignificant. On account of the dense population of the country the casual forest fires are quickly quenched. The principal cause of such fires is care-

lessness of various kinds. It is notorious that several forest fires have been caused by sparks from locomotives, but no number can be stated.

The administration of the state forests is under the Department of Agriculture; its yearly budget is voted under the general budget of finances and its officers are appointed by the king. The state forestry is managed by three forest masters, twenty-three superior foresters, sixty-nine foresters and 306 keepers. The superior foresters have the use of a house free of charge, together with a lot of arable land (30-100 acres) upon which they pay the ordinary taxes, besides a salary of \$950-\$1,250. The salary of the forest masters is \$1,450, to which is added an allowance for traveling and other lawful expenses. The three forest masters give in an annual report on the operations of the local ranges under their supervision. Three reports are prepared in the department and printed in a condensed form as a supplement to the public accounts. Every tenth year is issued a review of the state forestry in the past decennium. The "*Tidskrift Skovvasen*" (forestry periodical), published in Copenhagen by Mr. C. V. Prytz, professor of forestry in the Royal Agricultural and Forestry Academy, and "*Hedeselskabets Tidskrift*" (periodical of the society for the cultivation of heaths), published by "*Det danske Hedeselskab*" at Aarhus, are the periodicals. The revision of the decennial working plans for state forestry, which is simultaneous with the preparation of the working plan for the next ten years, is undertaken by a "*Skovtaxator*" (appraiser of forests), classed directly under the department, and four assistant clerks. A second "*Skovtaxator*" with one clerk is constantly occupied in the experimental line, in examinations of the growth of trees and the economy of divers modes of forest husbanding, altogether in support of practical forestry.

PRIVATE FORESTS.

The aggregate extent of private forests is 505,900 acres, of which, by the statistics of 1896, beech (*fagus silvatica*) comprises 44 per cent; oak, ash, maple, birch and alder comprise 18 per cent, and spruce (*picea excelsa*), pine (*pinus sylvestris* and *montana*), silver fir (*abies pectinata*), larch (*larix Europea*), etc., 38 per cent. Three-fourths to four-fifths of these forests are managed on forestry principles. The extent of private forests by the official statistics was, in 1888, 414,837 acres, and, in 1896, 454,874 acres. By the law of September 27, 1805, before mentioned, and which is still in force, private persons are prohibited from cutting their parts of the old forests of the country standing at that time, aggregating at that date an area of about 280,000 acres. This area comprises (besides the old forest area of the state, about 100,000 acres) the remnants of the original forests of the country still existing. Since 1850 very considerable areas have been planted with forests, both by the state and by private persons, especially in the heathy tracts of the peninsula of Jutland. In these tracts an area of 108,500 acres has, since 1868, been planted by private persons, however under the guidance and control of the "Hedeslskab" (society for the cultivation of heaths), which is aided by the state (for the year 1900 to the extent of \$73,000); and of the above area 54,600 acres were thoroughly cultivated at the close of 1898.

FRANCE.

The total extent of the forests of France (exclusive of the colonies) is about 23,500,000 acres, which represents about 17 per cent of the surface of the entire territory.

These forests are divided in: Forests of the state, 2,700,000 acres; forests of the municipalities and of the public

institutions, 4,700,000 acres; forests of individuals, 16,100,000 acres. The forests of the state and those of the municipalities and of the public institutions are managed and supervised by the Administration of Forests. France only extends over 9 degrees in latitude, but, as it has very high chains of mountains, the result is that it possesses all the climates of Europe, from the hottest to the coldest, and that a great variety exists in the species of trees that compose the forests.

The principal varieties of these species are: In the warm region, comprising the borders of the Mediterranean sea and of the Gulf of Gascony, the cork oak (*quercus suber*), the evergreen oak (*quercus ilex*), the cluster pine (*pinus pinaster*) and the Aleppo pine (*pinus halepensis*).

In the temperate region, comprising the plains, the rolling grounds and the lower parts of the mountains, the common European oak (*quercus ruber*), the European white oak (*quercus pedunculata*), the beech (*fagus silvatica*), the hornbeam (*carpinus betulus*), the common European ash (*fraxinus excelsior*).

In the cold region, comprising the middle and upper parts of the mountains, up to the extreme limit of vegetation, the silver fir (*abies pectinata*), the Norway spruce fir (*abies excelsa*), the beech (*fagus silvatica*), the Scotch pine (*pinus sylvestris*), the mountain pine (*pinus montana*), the larch (*larix Europea*).

STATE FORESTS.

The total area of the forests of the state, 2,700,000 acres, is composed of 2,100,000 acres of productive forests and of 600,000 acres of protective forests, situated in the mountains or on the dunes of the ocean; of lands recently purchased by the state on the banks of torrents and whereon timber is now being planted.

The forests yield annually to the state:

Timber (cubic feet)	33,800,000
Fire wood (cubic feet).....	62,300,000
Total	96,100,000

This represents nearly an annual production of 46 cubic feet of wood per acre of productive forest. The state forests produce in addition thereto oak bark, which is used in the tanning of leather; cork, rosin and several other small products; also hunting rights are leased.

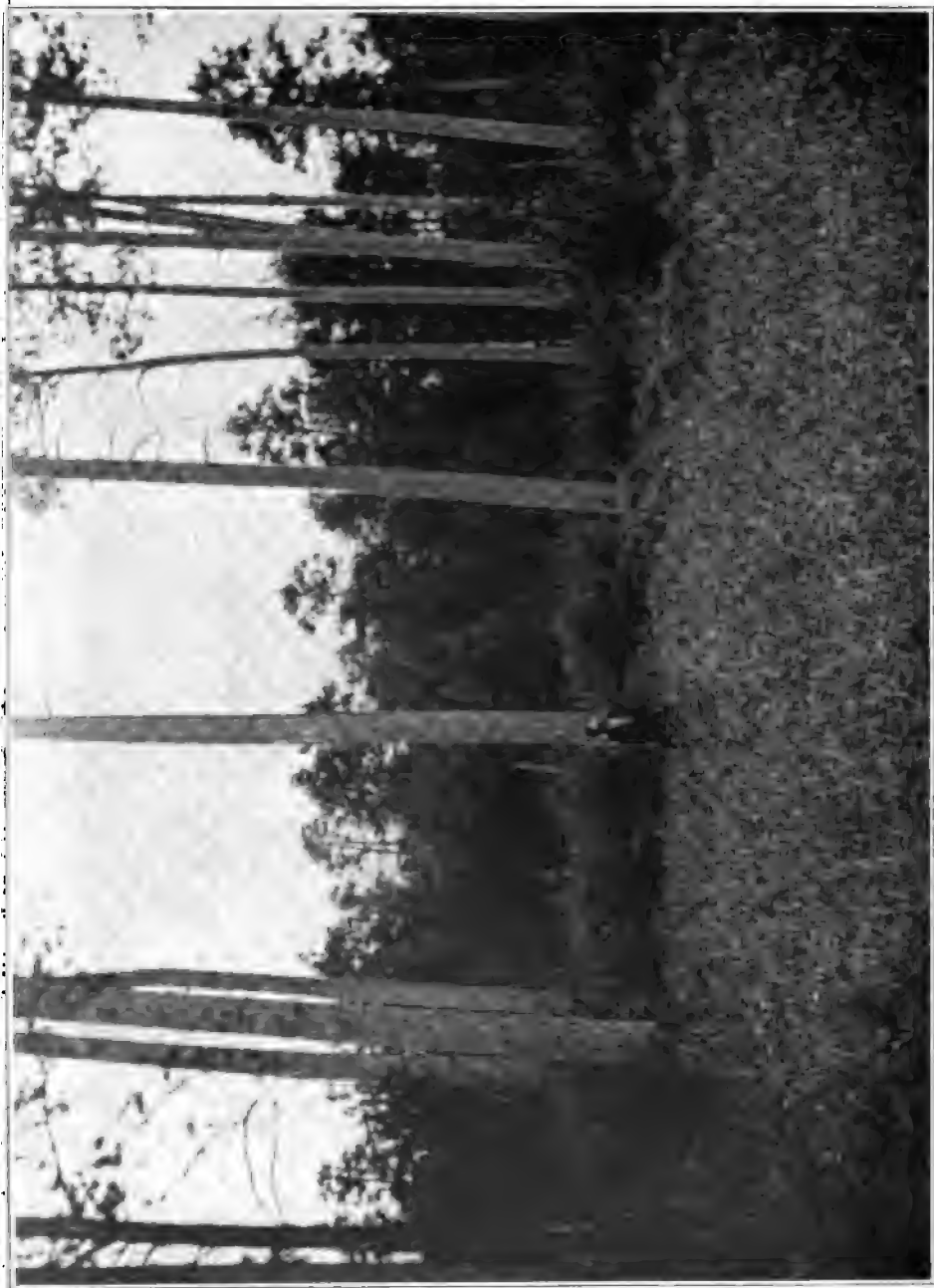
The gross annual income in money is \$5,500,000, or \$2.62 per acre of producing forest. In some forests this average is largely exceeded and it attains as high as \$8 per acre.

The expenses are as follows, viz.:

Labor	\$1,240,000
Forest instruction	35,000
Sundry works.....	360,000
Reforestation of mountains	700,000
Taxes paid to departments and municipalities.....	360,000
Sundry expenses	60,000
Total	\$2,755,000

But of all these expenses a large share is applied either in administering the forests of the municipalities or in executing works of real public utility in the "protection forests," or in reforestation mountain lands (to prevent slides and the like). If we make these several deductions we find that the expenses incurred in the producing forests do not exceed \$1,500,000 or 71 cents per acre. The net annual income of these forests is therefore \$2.62 less 71 cents, equal to \$1.91 per acre.

The state forests are carried on either as high forest or as coppice, and are managed under regulations made by the President of the Republic. Cuttings are made yearly. In forests rich in wood there is cut every year an amount equal to the increment or growth; in forests poor in wood



Young and mature red (Norway) pine four miles from Cutfoot, on the Winnibigoshish Reservation. Photographed for the Chief Forest Fire Warden of Minnesota, July, 1902.

they cut less than the increment in order to gradually increase the forest. The endeavor is made also to increase the production of the timber wood by reducing that of the fire wood. The "high tree forests" are cut down at periods ranging from 120 to 150 years.

The work is directed in a way that will insure natural reforestation from the seeds that fall from the standing trees. Not only the trees that have attained the age determined by the rules are cut down, but also the dead ones and those which are dying, and those that prevent the growth of neighboring trees. In temperate climate the annual cutting of high trees is on a limited area; a large number of trees are cut down simultaneously. In very cold climates and where winds are to be feared, only a few trees are taken away at a time on the same point, and cutting is then done on a larger area.

The low forest, coppice and second growth are cut in rotations, ranging from 25 to 35 years. The reserved trees, which are very numerous, are cut on an average every 100 years, but some selected trees are allowed to attain and even pass 200 years.

The labor performed in the forests consists in the construction and maintenance of forest roads, water saw-mills, houses for watchmen, replanting. Fortunately, owing to the system of culture now in use, artificial reforestation has but little importance in forests, properly speaking, but sowing and planting in the small open spaces, or on the points where a few more valuable species are to be introduced, or where the soil of the forest is better adapted to some varieties, there sowing and planting are more frequent. The average cost of such work is \$10.00 per acre.

Very considerable reforestation is made on mountain lands, where the state plants trees to regulate the action of the waters and stop the ravages of torrents. For that purpose \$700,000 are expended every year, the

largest part of which is used in the purchase of land, and the other part in dams to regulate the streams, and in plantations to settle and retain the soil. The state purchases yearly, on an average, 16,000 acres. The average cost of reforestation is \$20 per acre, and \$18 must be added thereto for work in improving the streams, building roads, etc. Planting is preferred to sowing on calcareous or chalky soil.

The administration of the forests forms part of the Department of Agriculture. It has charge not only of the direction and care of the forests of the state and of those belonging to municipal corporations and public institutions, but also the overseeing of the fishing in the rivers and creeks. At its head is a director, residing in Paris, who has under him: A central service composed of 3 administering general inspectors, 10 inspectors, 5 assistant inspectors and 17 clerks.

An exterior service composed of:

First—Personnel superior or of administration—32 forest keepers, 200 inspectors, 215 assistant inspectors, 250 general wardens.

Second—Personnel inferior or of surveillance—3,500 foremen and wardens, paid by the state; 3,700 foremen and wardens, paid by the municipal corporations and public institutions.

The annual salaries paid are as follows:

SUPERIOR OFFICIALS.

Director.....	\$3,000
Administrators.....	1,800 to 2,600
Forest keepers.....	1,600 to 2,400
Inspectors.....	800 to 1,200
Assistant inspectors	600 to 800
General wardens	300 to 520

Exclusive of some additional allowances for traveling expenses.

INFERIOR OFFICIALS.

Foremen and wardens paid by the state an average of ..	\$160.00
Foremen and wardens paid by the municipal corporations and public institutions	116.00

The foremen and wardens receive in addition thereto allowances of firewood, tillable land, pasture grounds, etc.

Those in the employment of the state have free rent in houses built in the forest, or in lieu thereof they receive as compensation a cash equivalent.

The superior officials are entitled to a retreat pension at the age of 60 years, and the inferior officials at the age of 55 years.

France has three forestry schools. One school of higher instruction at Nancy; one school of secondary instruction, and one school of primary instruction. The two latter schools are established in the department of Loiret, on the possessions of the administration at Barres.

FORESTS OF MUNICIPAL CORPORATIONS AND OF PUBLIC INSTITUTIONS.

The forests of municipal corporations and of public institutions comprise 4,700,000 acres. They are supervised by the Forest Service on the same conditions and according to the same principles as the state forests. They contain about 200,000 acres of forests for protection, and their producing area is thereby reduced to 4,500,000 acres. They produce annually, timber, 42,000,000 cubic feet; fire wood, 128,000,000 cubic feet, and together, 170,000,000 cubic feet. This represents nearly an annual production in wood of 38 cubic feet per acre of productive forest. The annual cash value of the product, including the bark, cork and rosin, is \$6,400,000, or \$1.42 gross income per acre. The net income is about \$1.14 per acre. The forests belonging to the municipalities and public institutions are under regulations approved by the president of the republic. These regulations and those of the state

forests have been established with a view of insuring a continuous annual production and even of increasing that production in the forests where it is not yet sufficient.

PRIVATE FORESTS.

Private individuals are at liberty to manage their forests as they please. But they are prohibited from cutting and taking trees from forests which are necessary to maintain and regulate water flow, to protect lands against the encroachments of the sea and sands, to defend the territory, or which are necessary for the public health. The destruction of private forests has become rarer and rarer and the proprietors acknowledge now that on soils of poor quality the income from forests is greater than that from arable land. As a result the area of private forests, instead of decreasing, increases from year to year by reason of the timbering of lands on which agriculture pays but small profits.

The income from private forests in quantity and in money is not exactly known. It is, however, known that on the same area they pay less than the state forests. Private individuals in their anxiety to get returns are inclined to cut down the wood when it is too young, and in the forests where coppice wood is raised they do not leave a sufficient reserve, and oftentimes leave none at all. One can notice, however, that the principles of silviculture are spreading more and more in the culture of private forests. The large forests are subjected to the same mode of management and are treated like the state or municipal forests. On the whole the annual production is regular and tends to become better in both quantity and quality.

FOREST FIRES.

In the temperate and in the cold regions of France (that is, in the larger portion of the territory) the fires are but few and cause slight damage. The long periods of

drought are not frequent, the numerous roads that run through the forests make very good lines of defense, and the villages that surround the massive wooded areas furnish at the first alarm devoted laborers. The railroad companies, being held responsible for damage by fire caused by flying sparks from their locomotives, take particular care, and in exposed places cut the grass and brush along their roadbeds.

The forestry code forbids, under penalty of \$4 to \$20, carrying or lighting matches in or within a distance of 200 metres from the forests.

In the forest camps of the state, municipal corporations or public institutions, it is forbidden to the workers to light fire outside of the buildings or shops, the location whereof is indicated by the forest service.

In the warm region the dangers from fires are greater. As a preventative against them more roads are built, trenches 20 to 50 metres wide and kept free from grass and brush are made around the forest, along railroad lines, on the dividing lines between forests belonging to several owners, and also from distance to distance in the large and dense forests belonging to the same proprietor. The use of fire in forest camps and in agricultural camps situated within 200 meters from the forests is forbidden during the months of June, July, August and September. A special watch is organized, and telegraphic lines penetrating the center of the forests admit of alarm of fire at its start and call for help. If the working force appears to be insufficient the military authority furnishes the deficiency and sends on the spot soldiers who act according to the directions of the forest service.

COLONIES.

France, fully convinced that the preservation of forests is in all lands of the highest importance, has organized a forest service in its possessions outside of Europe—in Al-

geria, Tunis, Madagascar, Indo-China, Reunion. In Algeria the organization is exactly similar to that of France, and calls for an annual expenditure for salaries and works of \$600,000.

HESSE-DARMSTADT.

STATE FORESTS.

The state forests of the Grand Duchy of Hesse-Darmstadt occupy 165,000 acres, and are situated in the Rhine valley (on alluvial sand), in the Vogelsberg mountains (on basalt and red sandstone), and in the Odenwald mountains (on granite, syenite and red sandstone). The prevailing species are beech, occupying 40 per cent, Scotch pine, occupying 34 per cent, and oak, occupying 16 per cent of the area under forest; whilst the remaining 10 per cent consist of spruce, fir, larch, alder and birch forest. It is a noteworthy fact, proved from the writings of Cæsar, Tacitus and of early German authors, that there were no coniferous trees present in their time except yew. Pine was introduced only from the 15th century on. The average value per acre is about \$100; but there are great differences according to quality of soil, transportation facilities and density of population. The annual aggregate expense of administration is \$148,500; and the annual aggregate revenue is \$561,000. There are planted annually to forest 750 acres, the planting extending over the entire surface of the ground. On 2,500 acres, according as "blanks" in natural regenerations are stocked, partial planting takes place. There are used on an average per annum: 110,000 pounds of seeds of broad leaved species; 4,000 pounds of seeds of coniferous species; 5,000,000 broad leaved seedlings; 5,000,000 coniferous seedlings. The annual expense for starting new generations of trees





Norway pine on Pike Bay, U. S. Forest Reserve. Photographed July, 1902, for the Annual Report of the Chief Forest Fire Warden of Minnesota.

aggregates \$22,000. Beech is invariably raised from the seed dropping from mother trees evenly distributed. Scotch pine is planted when one year old, over 10,000 seedlings being used for each acre. Spruce and fir are planted when four years old, or seeds are sown in strips being about four feet apart. Oak is either planted as a seedling two feet to three feet high, or acorns are dibbed in, the method used depending on local conditions. All plants are raised in forest nurseries, kept under the care of local forest rangers. Comparatively large areas are covered with oak-coppice forest, which is copped every 15 to 20 years, with a view of obtaining tanning bark. White pine and douglas fir have been introduced with splendid success. American red oak and hickory seem to answer the local conditions fairly well.

In certain densely populated sections, where soil fit for agriculture is scarce, field crops (potatoes and rye) are raised together with tree crops during the first three to five years following the cutting of mature trees. Rows of potatoes alternating with rows of pine seedlings are frequently seen. This combination reduces the expense of reforestation. It secures for the seedlings a soil of high porosity, whilst it exhausts, on the other hand, the mineral contents of the ground and the accumulated layer of humus.

Reforestation is effected on about 40 per cent of area by seed from standing trees; on about 10 per cent of area by coppicing and on about 50 per cent of area by artificial sowing and planting. The annual yield is strictly sustained. The yield per acre per annum is 74 cubic feet, of which not less than 60 cubic feet is used as fuel. The value of cordwood piled up along forest roads is about \$2.50 per cord. The value of logs cut and hauled to forest roads is about \$11.25 per 1,000 feet board measure. As to the usual method of cutting a crop, about 30 per cent of the yield is made up of stuff obtained from thin-

nings. The remaining 70 per cent consists of mature trees. Wherever regeneration is effected from self-sown seed, the mature trees are gradually removed. Where planting is resorted to, a clean sweep is made of all mature trees over areas aggregating about 25 acres on an average. Large clearings are considered a mistake, as it is difficult to restock them.

With regard to compulsory reforestation the following may be said: Private forests must be planted up within three years after the removal of a mature crop. Exemptions from this rule may be granted, upon application, by the State Forestry Bureau. Waste land planted up by the owner is, once for all, exempted. If a forest owner hesitates to replant his clearings within three years after the cutting of the trees, he is subject to a fine. The forest authorities will replant the clearing at the owners' expense, the owner being allowed the choice of species. Any treatment of forests likely to result in permanent unfitness for the production of timber, is prohibited.

Little damage is done, generally speaking, by forest fires. On the average annually 54 fires are reported, running over 45 acres altogether, and resulting in an annual loss of \$533. In 28 cases out of 272 cases the forests were so badly damaged that it was considered wise to cut the trees and replant the area thus cleared. The principal cause of forest fires is carelessness of smokers. A few only of such fires are annually caused by railroad locomotives, perhaps three annually.

The rank of the forest officer corresponds entirely with the rank of officials in other branches of the public service. The average salary per year of the "Oberforstrat" is \$1,300, of the "Oberforstmeister" \$1,125, of the "Oberforster" \$825, and the office and transportation expenses of the last two named are \$350 and \$200 respectively. No official report is published, either annually or periodically.

PRIVATE FORESTS.

The extent of private forests is as follows: Communal forests, administered by state foresters, 235,000 acres; entailed forests, owned by families, 132,000 acres; ordinary private forests, owned by individuals, 70,000 acres; total, 437,000. All communal forests and all entailed forests are managed on forestry principles, furnishing a sustained yield. The condition of the ordinary private forests is deteriorating, as the productiveness of the soil is abused by pasture, removal of litter and incomplete density of leaf canopy. Communal and entailed forests are worth as much as state forests, namely, about \$100 per acre. The value of private forests owned by individuals is considerably less. The average rate of net income is about $2\frac{1}{2}$ per cent. The total product of the country is well sustained.

Considerable sums are derived in state and communal forests from hunting and fishing leases. The foresters of all grades enforce, *ex-officio*, all fish and game laws. The subaltern foresters, as a general rule, are taken from the army.

The wages of the common laborer average about 50 cents per day. In the mountainous sections wood fuel is cheaper than coal. In the state forests \$24,700 are annually spent for new roads, or for macadamizing old roads. The state oberforster is at the same time the manager of all municipal or village forests lying within his district. The sale of forest produce, however, is done by the mayors of towns and villages. A splendid system of well graded public roads, covered with stone in the Tellford system and maintained at an annual expense of \$270 per mile, facilitates economic forestry to a very high degree.

ITALY.

STATE FORESTS.

It was a peculiar pleasure to receive, as I lately did, from the Ministry of Agriculture at Rome, an account of the forestry of Italy, that beautiful country which dates back thousands of years and whose woods have been sung by Horace and Virgil. The aggregate area of the state forests is 128,960 acres, principally situated in Tuscany—provinces of Florence, Arezzo, Grosseto, Pisa and Leghorn; and Venice—provinces of Belluno, Treviso and Udine. These lands are regarded as inalienable. The prevailing kinds of trees are oak, beech, pine, larch and fir. The total annual expense of administration averages about \$80,000. The annual sale of the raw material from the state forests averages \$150,000. The number of acres annually reforested with trees is 150. The method of reforestation varies according to the different species of trees and the local conditions; but seeding, whether artificially or naturally, is used only for the oak and the beech. For other kinds, such as the fir, pine, larch and chestnut, reforestation is done by planting. Generally good care is taken to maintain a sustained yield. In regard to cutting, the practice is to cut only those trees which have reached fiscal maturity and those that are dead or about to die.

The damage caused by forest fires amounts to about \$80,000 a year. The causes are principally accidental. Only a very small number of forest fires are caused by railway locomotives. The forest service has much importance in the protection of mountainous land and in the control of water. The annual salary of the chief inspector of the forests of the first class is 6,000 lire; that of the chief inspector of forests of the second class, 5,000 lire; that of inspector of forests of first class, 4,000 lire.

The Minister of Agriculture generally publishes a detailed report on the administration of the forests every five or six years.

NORWAY.

STATE FORESTS.

The extent of the state and semi-public forests of Norway is 2,587,500 acres. Of these, 837,500 acres are located in the provinces of Tromsø and Finnmark; 140,000 in that of Norrland; 285,000 in North Drontheim, and 225,000 acres in South Drontheim and Romsdal, and about 397,500 acres in Hedemarken. The prevailing kind of trees are pine (*pinus sylvestris* L.), spruce (*Abies excelsa* D. C.), and two species of birch. The average estimated value of the forest land is \$2.70 an acre. The annual aggregate expense of administration is about \$108,000, and the annual aggregate revenue varies from \$60,000 to \$67,500. The number of acres annually sown or planted to forest varies from 150 to 175 acres. Reforesting is almost entirely effected by natural seeding from standing trees, and, when artificial culture is employed, by planting trees. The crop of forest production is periodical, and depends partly on the market prices of lumber. The forest administration tries to prevent the yearly average yield exceeding the net increase of the forest. Cutting must in part depend on the demand. Where it does not pay to cut smaller trees, the mature ones are principally cut, while at the same time, as far as possible, diseased and injured trees, as well as such as would hinder in the growth, are removed. Where, on the other hand, trees of smaller size can be profitably sold, small blocks are cut clean in order better to promote new growth.

The law of July 20, 1893, on the preservation of "Protecting Forests" and against the destruction of forests, has special provisions relating to "Protecting Forests," by which are meant forests serving as a protection against snow avalanches, stone slips, alteration of river beds, shifting sand, or as a special protection to other forests or to inhabited country. "Protecting Forests" are also such as bound districts and mountain forests, which, from their situation on the slopes of high mountains or in the neighborhood of the sea, or in the far north, grow so slow that they would die out if neglected. Under "Protecting Forest Lands" are also included bare fields, to be planted in the future to serve as other "protecting forests." The municipal council selects three men, who, after consulting the public forest officer, propose the localities within the district to be considered as "protecting forests." The municipal council has then to fix the boundaries of the forests, and on the proposition of the forest inspector of the district to determine the rules for its management. These regulations must have the sanction of the king to be valid. The municipal council can also make reservations, subject to the king's approval, against the destruction of the forests in general. Such municipal regulations relating to "protecting forests" and forests in general may probably also include compulsory regulations as to planting and sowing of forests already cut down. No other laws relating to forest culture exist in Norway.

The damage caused by fires in the public forests is inconsiderable. Many years there is none; and the damage done to private forests is of small account and unreported. The principal cause or causes of such fires is carelessness of owners, fishermen, cowherds, etc., as well as the burning of heather for cultivation of the land. The law of July 14, 1893, on "Fires in Forest and Fields," with the supplemental law of July 27, 1896, has provisions relating to the prevention and extinction of forest fires.

The central administration of the forests is directly under the department of the interior, without intermediate officers. The service is under the charge of the chief (the director of the forests), and there are 4 forest inspectors, 25 forest officers, 1 forest engineer, 2 assistants, 7 forest planters and 363 forest guards. The yearly salary of the chief (the director) is \$1,450, without additions. The inspector's salary is \$800, increasing up to \$970. The forest officers, \$480, increasing to \$800. All these functionaries have their traveling expenses paid when traveling in the service of the state. The officers and the inspectors hand in every year a report to the director, who publishes a report on forest matters generally every third year. The only forest periodical in Norway at present is the "Tidsskrift for Skovbrug," (Periodical for Forestry), published by the Norwegian Association for Forestry.

PRIVATE FORESTS.

The aggregate extent of private forests is 18,000,000 acres, of which about 276,000 acres are managed on forestry principles. The average value per acre is from \$4.28 to \$5.36, and the average annual rate of net income is from 55 to 60 cents per acre. The cutting undoubtedly exceeds the natural increase of the forests. The supply of wood is consequently decreasing, and the size of the trees decreases. The government purchases annually forests to the amount in value of \$21,440. It has three large and several smaller nurseries. These supply the required number of plants to the public and to private parties. It has also four seed establishments, which supply the public and private demand for tree seeds. It also has two elementary schools of forestry, and it tries through its functionaries to instruct forest owners in rational management of the forests.

PRUSSIA.

STATE FORESTS.

The extent of the state forests of Prussia is 6,955,227 acres. Included in this, however, are 715,637 acres not designed for tree culture. In addition, the extent of forests belonging to municipalities is 2,563,812 acres; belonging to churches, 207,752 acres; belonging to corporations, 555,900 acres; private forests, 10,828,730 acres; making an aggregate extent of 21,111,421 acres in the whole kingdom.

The prevailing kinds of trees in the state forests are Scotch pine, larch, beech, red pine, fir and oak. The value of the land varies so much, rising from a small amount to \$700 per acre, that it is impossible to give an average estimated value. The annual aggregate expense of administration (state forests) is as follows: The office expenses and maintenance, including expense for education in forestry, etc., averaged in the years 1893 to 1897, per annum, \$8,500,000. The annual aggregate revenue in the years 1893 to 1897 amounted to \$17,200,000, being at the net rate of \$1.50 per acre of actual forest. The number of acres sown or planted with forest annually during the years 1893 to 1895 was 44,830.

The foresting of the beech is mostly effected from standing trees, though artificial sowing and planting are also done. The oak is either reforested by seed from standing trees, or artificially through sowing or by planting. The Scotch pine is first cut clean and reforested by sowing or planting, and the red pine the same. Sowing from standing trees is not common. In regard to the continuity of forests products, the forestry department endeavors to obtain the highest possible continuous net income. The usual method of cutting is in blocks clean.

Under the head of compulsory tree planting the following laws are referred to: The Forest Protection Law of

July 6th, 1875, the law of August 4th, 1876, concerning the administration of forests owned by municipalities and public institutions in the provinces of Prussia, Brandenburg, Pomerania, Posen, Silesia and Saxony.

The average annual damage caused by forest fires in the years 1892 to 1896 was as follows: Totally or mostly destroyed, 2,992 acres; only slightly damaged, 117 acres; only the surface destroyed, 522 acres. The average annual number of forest fires in the years 1892 to 1896 was 36, the causes of which were as follows: 12 unknown, 2 railroads, 5 incendiary, 16 caused by carelessness, 1 lightning. During the years 1892 to 1896 the annual average number of forest fires caused by railroad locomotives was 2.

The officers in the forest service are equal in rank to the other high grade officers in the government service. The foresters have clerical rank. The salary of "Oberforster" (district manager) ranges according to length of service from 2,700 to 5,700 marks. Unfavorably situated officers receive an additional amount, the maximum of which is 600 marks annually. In addition there is usually free residence and fuel. The salary of the "Oberforstmeister" (chief inspector) is from 4,200 to 7,200 marks, according to length of service, which is calculated from the time of qualification for the office of "Forstrath" (councillor). The "Oberforstmeister" and "Forstrath" are each allowed an amount not exceeding 2,900 marks for traveling expenses.

PRIVATE FORESTS.

The extent of private forests in Prussia, as above stated, is 10,828,780 acres. About one-half of these forests are managed on forestry principles, and their average value is somewhat less per acre than that of the state forest. On the larger estates the area devoted to forests gradually

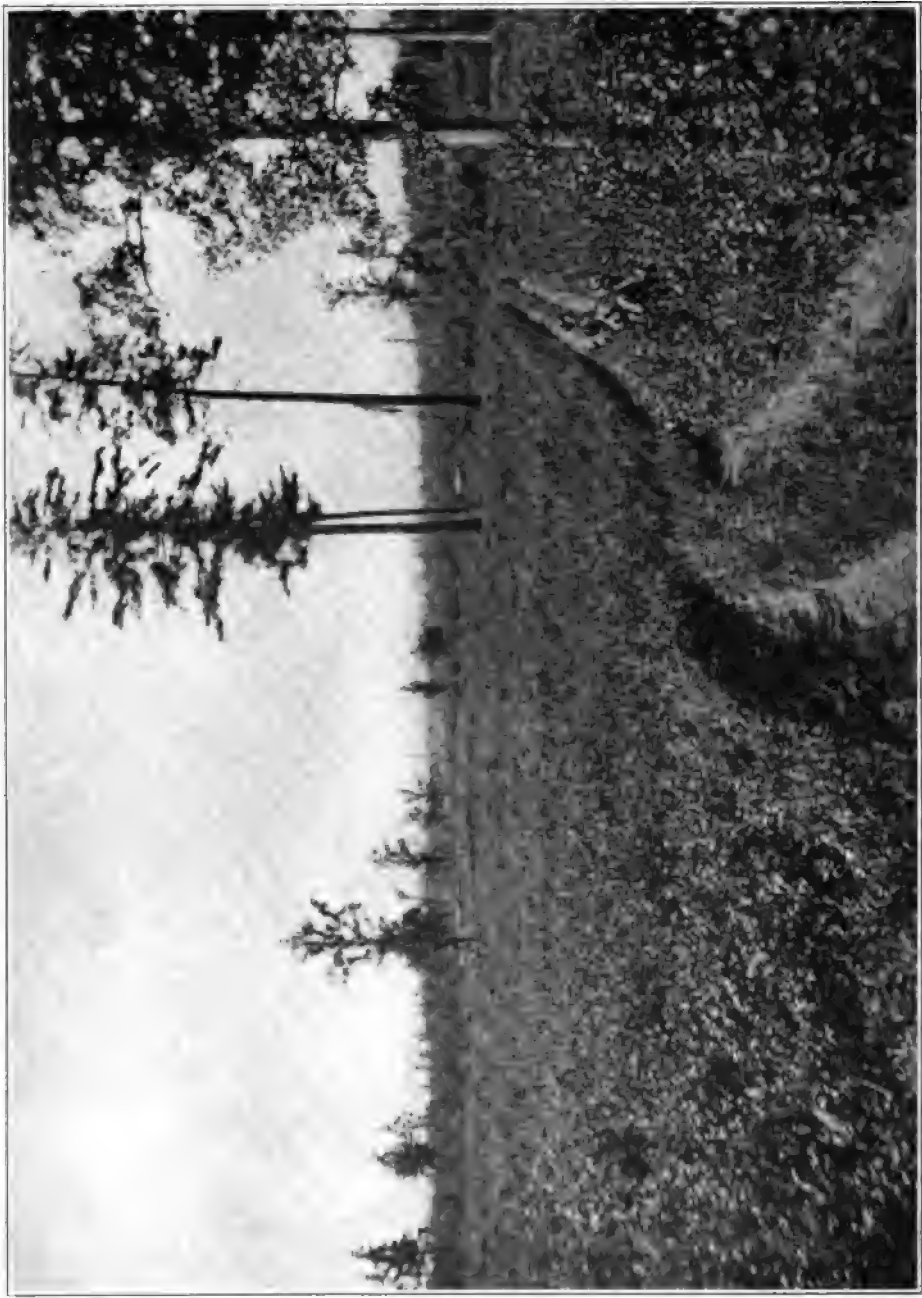
increases, while on the smaller estates the forest area probably decreases.

Some of the forests of Prussia are attractive resorts for travelers, and especially pedestrians, who enjoy the excellent roads. Of the celebrated Thuringian chain, which is 70 miles in length by from 8 to 25 miles in breadth, a writer says: "The successive hills melt into each other in gentle undulations, forming a continuous and easily traced comb, and only the northwest slopes are precipitous, and seamed with winding gorges. This mountain range incloses many charming and romantic valleys and glens; the most prominent feature of its picturesque scenery is formed by the fine forests, chiefly of pines and firs, which clothe most of the hills."

Prussia comprises nearly two-thirds of the entire extent of the German Empire, yet its area lacks considerable of being twice that of Minnesota. Thirty-one per cent of its soil is predominantly sandy, and on the whole probably is not as good as that of Minnesota; yet it sustains a population twenty-five times as large as that of Minnesota. This fact might well find a lodgment in the minds of our statesmen, that whereas Prussia annually derives a net revenue of \$1.33 an acre from her 6,000,000 acres of state forest, our state, from about an equal area of land in its borders, adapted to forest, derives no regular net revenue at all.

DUCHY OF SAX-MEININGEN.

The area of state forests is 106,530 acres; of communal forests, 84,460 acres; of private forests, 71,850 acres; miscellaneous, 1,480 acres; in the aggregate, 264,310 acres, being equal to 42.4 per cent of the total area of the state. The state forests comprise 24 units of ad-



Sample of Cleared and open country on the Winnibigoshish Reservation. Photographed July, 1902, for the Annual Report of the Chief Forest Fire Warden of Minnesota.

ministration, in charge of 24 superior forest officers. The highest functionary in forestry matters is the president of the forestry bureau. The bureau is composed of five forest counsellors, two of whom act as forest inspectors at the same time, each one supervising 12 of the above named 24 forest officers. The annual yield of the state forests is 5,779,669 cubic feet of lumber and fire-wood cut in ripe forests, and 1,288,904 cubic feet of fire-wood and pulp-wood obtained from thinnings. These figures correspond with an annual yield of about 155 feet board measure of lumber plus 0.40 cords of fire-wood per acre per annum. The state forest officers at the same time control the management of the communal and private forests within the state. All grades of forest officers have certain police duties concerning forests, fish and game preservation.

The municipalities owning forests are required to appoint well trained foresters for the management of their forest realties.

SAXONY.

STATE FOREST.

The aggregate area of the state forest is 432,000 acres. The forests are scattered over the Erz mountains themselves and over their outskirts. They are further situated in a few smaller and separate mountain ranges and in the plains. The altitude at which the state forests are found ranges from 100 to 1,200 meters, or from 328.1 feet to 3,937.2 feet, above sea level. The first group of forests, in the Erz mountains, is pretty compact and comprises 200,000 acres. The second group, in the outskirts of the Erz mountains and in some smaller distinct mountain ranges, comprises 136,000 acres; and the third group, in

the plains, comprises 96,000 acres. The soil consists of decomposed granite, granulite, gneis, mica-slate, clay-slate, grauwacke, porphyry, sandstone and some basalt. In the plains there is diluvium and alluvium. Only a very small portion of the forest area might be deemed fit for agricultural use.

The principal tree species are spruce, *picea excelsa* (Link); Scotch pine, *pinus silvestris* (L.); silver fir, *abies pectinata* (D. C.); larch, *larix europæ* (D. C.); rothbuche, *fagus silvatica* (L); oaks, *quercus pedunculata* (Ehrh.), and *qu. sessiliflora* (Sm.); hornbeam, *carpinus betulus* (L.); ash, *fraxinus* (L.); several maples, namely: *acer pseudoplatanus* (L), *A. platanoides* (L); further, several species of elm, *ulmus*; of birch, *betula*; and of linden, *tilia*. The prevailing species is spruce.

The value of the state forests, including timber and soil, aggregates \$76,490,000. Hence the value per acre is \$177. The annual expenses for administration for the year 1896 were \$1,040,000. In the year 1896 the annual gross revenue amounted to \$2,986,000; the annual net revenue to \$1,946,000.

The entire area planted annually varies according to circumstances. On the average it will reach 6,900 acres. Of these 6,900 acres 800 acres are planted up with seeds and 6,100 acres are planted up with plants. About 20 per cent of the above figure 6,900, or 1,380 acres, consist of blanks in plantations previously made where the original planting has failed. Thus it appears that the area planted for the first time after the removal of the old crop is only 5,520 acres. The question whether plants or seeds shall be employed for restocking cleared ground depends on the condition of the soil. As a general rule, seeds are planted only on such areas which do not produce grass and weeds to a large extent and which at the same time are of sufficient fertility and well protected against late frost. The sowing or planting of seeds must

be done not later than in the second year after the final removal of the former tree crop. Strips about three feet wide or places about six feet square are cultivated with a spade before the seed is thrown on them. Only in rare cases the entire area to be planted with seeds is ploughed and harrowed and the seeds spread over it broadcast. The plants used for planting up a clearing are as a rule two years old or older. The age of the plants selected depends on the condition of the area to be planted aside from depending on the species itself. Spruce, Scotch pine, fir and larch or tamarack, as a general rule, are used two to five years old; beech, oak, ash and maple, as a general rule, are used three to six years old. The plants are raised in nurseries. Only in rare cases they are taken from areas previously planted with seed in the open forest. The number of plants used per acre ranges between 600 and 4,000, according to the species, the size of the plants used and the condition of the area to be planted.

Regeneration from self-sown seed is only used in the case of the beech (*Fagus silvatica*). In all other cases forests are regenerated by means of planting plants or sowing seeds.

There is no law or rule in Saxony for compulsory reforestation after clearings.

There is not much damage done by forest fires. It averages \$300 per year. Forest fires of a larger extent have happened very rarely. As a rule, forest fires are caused by the careless use of matches by tobacco and cigar smokers. Very few fires are caused by sparks from locomotives; on the average perhaps three per year.

The yield or annual cut is fixed by working plans prepared for periods of ten years and renewed after the lapse of such periods. Within these periods the annual yield is almost constant. At the end of a period, however, a new working plan might provide for either a higher or

lesser yield. It is an iron-clad rule that on the whole the cut shall not exceed the increment of the forest.

Trees are cut as low down as possible above the surface of the soil; the instrument used is the saw. The stump and the root are dug out afterwards wherever such work is remunerative, viz., where the wood obtained can be sold at a paying rate. In Saxony regular forest management began with the beginning of the century in a systematic way; consequently the forests now existing are almost even aged and composed of trees of almost even size; hence there is no objection to clearing an entire area of given size, say of two or three acres, at once, removing from it every tree standing on it. In exceptional cases, pieces of forest not entirely mature may be sacrificed with a view of saving others from the dangers threatening from storms and insects.

The average age of maturity in Saxony for conifers (spruce) is eighty to ninety years. However, there are cases in which this rule is not adhered to. The size of trees when fit for the axe depends entirely on the species, on the condition of the locality, the means of transportation, etc. Previous to the final cutting, and beginning with the twenty-fifth year of a piece of forest, and ending at the sixtieth year of the forest, thinnings take place at intervals of about ten years with a view to allow increased light and increased space to the most promising specimens of the growing stock. Specimens growing less vigorously, dying or dead, are removed at the same time wherever it pays.

There is no difference in the rank of the forest officer compared to that of any other state officers employed in the technical branches of the government. The state forestry service is divided into a lower and higher branch. The professional training for the first one is a merely practical training, whilst the latter necessitates scientific preparation of a high class. The requirements with reference

to this scientific preparation are as follows: Graduating from a state gymnasium; six months of practical instruction under a forest officer on one of the state forest ranges; twelve months' study at a university; two and a half years' study at the forest academy at Tharandt, at which two examinations must be passed; three years of practical professional training under a forest officer and at the bureau of forest working plans at Dresden; examination by the state authorities. After this preparation, as soon as there is a vacancy, appointment as government officer might follow, to begin with as assistant of an Oberförster (Superior Forester); then as superior forester, and so on up to the higher ranks of chief of a forest territory or chief of the bureau of forest working plans. The latter officers have the title of "Superior Forest Master." The highest technical authority controlling the local and territorial officers is called "State Forest Master." There are 108 local ranges in Saxony allotted to 11 territorial districts. The former are in charge of a superior forester (Oberförster), the latter in charge of a superior forest master. The central bureau of the entire state forestry service is under the Secretary of Finances.

The salary of a superior forest officer averages \$1,015 (from \$1,150 to \$1,180), to which must be added an allowance of \$566 for traveling expenses, horse keeping and the use of a house free of rental. The salary of the Superior forest master averages \$1,486, ranging from \$1,274 to \$1,698, to which must be added a traveling allowance of \$708 and the use of a house free of charge.

In the case of physical disability the forest officers draw a pension depending on the duration of their state service and on the salary received so far. This pension is at least 30 per cent of the salary. In no case does it amount to over 80 per cent. The latter figure is paid after thirty-nine years or more of state forestry service. At the age

of sixty-five years the state forestry officer is entitled to a pension in case he desires to retire, even if his constitution would enable him to continue in the service.

No annual report of the Saxony forest administration is published.

"Das Tharandter Jahrbuch" is considered the best periodical on forestry.

As further information, it may be stated that the administration of a forest range, by the superior forester under the supervision of the superior forest master, is outlined by "the working plan" which is prepared by the bureau of forest working plans at Dresden, containing prescriptions for a period of ten years. The superior forest officer co-operates in the preparation of this working plan, which has to be submitted to the secretary of finances. The preparation of a working plan is based on a thorough knowledge and a thorough scrutinizing of the conditions of the forest range, which often takes several months. The forest working plan contains a statement showing the areas of the different compartments or units of the forest range; it contains a description of these compartments and maps of the same; all sections of the forests are examined with reference to their increment. All these investigations made, the forests or sections of forests to be cut during the next decade of years are selected and pointed out specifically. Further, there is stated specifically what compartments or sub-compartments are to be thinned out, what areas are to be planted up, and by what means regeneration is to be effected in each single case. Deviations from the prescriptions of a forest working plan must not be made unless authorized by the secretary of finances. Every working plan is controlled by the state forest master in the range itself. Besides, in the midst of the ten years period, or after the lapse of five years, such a control by the highest forest officer of the state takes place, so as to find out whether and in how

far the prescriptions of the working plan have been followed and whether deviations might be advisable.

The sale of the forest produce (timber, fuel, bark, stones, etc.) is done by the superior forest officer with the help of a local state cashier, who is holding an office absolutely independent from the forestry service and is directly subordinate to the secretary of finances. This arrangement makes embezzlements practically impossible. The sale of timber and fuel takes place, after they are cut and piled up, by means of public auction. The cutting and piling of timber and fuel is done by common hands working under a contract. Any planting, on the other hand, is done by day workers, under the supervision of the local rangers, so as to warrant careful work.

PRIVATE FORESTS.

According to a statement made for the year 1893, the total area of the private forests in Saxony is 539,000 acres. All forests owned by municipalities and villages and other corporations, and a considerable fraction of the larger private forests, are managed according to true forestry principles. All administrations of municipal, town and village forests are controlled by the state. The working plans for these forests are prepared by the bureau of forest working plans at Dresden. In these cases, the forest working plan is approved of by the secretary of the interior, and not by the secretary of finances, as would be the case for state forests.

It is impossible to give any data as to the average value per acre of communal and private forests. Neither are data available as to their average annual yield. Generally speaking, the yield of private and communal forests is considered to be lower than from state forests. Wherever there are working plans the cut is steady, and even during the period over which the working plan extends.

Where there are no working plans, the cut depends entirely on the pleasure of the owner.

Small holdings of forests, especially those of the peasantry, are deteriorating. Parts of such forests are changed into fields or meadows; other sections are purchased by the state, communities or wealthy private individuals.

GRAND DUCHY OF SAX-WEIMAR.

The area of state forests is 110,910 acres, of private forests 120,510 acres, in the aggregate 231,420 acres, being equal to 25.6 per cent of the total area of the state. The state forests comprise 37 units of administration, in charge of 37 superior forest officers, trained at the forest academy of Eisenach.

The control of the local forest administration is effected through six forest inspectors, the highest authority in forestry matters being represented by a forestry bureau, attached to the office of the secretary of finances. Forest working plans are prepared and their execution controlled by the "Commission of Forest Working Plans," at Eisenach, the director of the forest academy being at the same time chief of that commission. The annual yield of the state is 5,864,177 cubic feet of lumber and fire-wood, corresponding with about 125 feet board measure timber plus 0.31 cords fire-wood per acre per annum.

The main duties of the superior forest officers consist of: Care of the property; maintenance of boundary lines; preventing the acquisition of prescriptive rights to pasture, litter wood, etc., by outsiders, and preventing forest offenses; maintenance of the growing stock of timber; forest utilization and forest regeneration, as prescribed by the working plans; sale of forest produce and control of the book-keeping.



Mature and young Norway p
3 miles northwest of Cutfe
Report o

x on the Winnibigoshish. reservation
Chief Fire Warden of Minnesota.

photographed July, 1892, for the Annual

SWEDEN.

STATE FORESTS.

The aggregate extent of the state forests of Sweden in 1895 was 18,080,753 acres. The area of state forests is annually increasing by extensive purchases of private forest. The prevailing kinds of trees are spruce (fir), pine and birch. The estimated value of the state forests is \$4 per acre. The figures in this statement are for the year 1895, in which the aggregate expense of forest administration was \$185,397, and the aggregate revenue was \$1,126,636. The number of acres sown or planted to forest was 10,875. The number of acres damaged by fire was 1,200, and the amount of damage was about \$10,000. Neglected camp fires and carelessness when burning fields for cultivation are the principal causes. Only three fires were caused by railroad locomotives. The state forests are divided into 9 districts and 74 ranges ("revir"). The chief of a district is an officer entitled "Öfverjägästare," with annual salary of \$1,707 and rank corresponding to the rank of major in the army; the chief of a range ("révir") is an officer entitled "Jägästare," with a salary of \$1,200 and rank corresponding to that of captain in the army. Before any one can be appointed as "Jägästare" he must have passed successfully the examinations required after a year's attendance at one of the forest schools, the examinations required during a two years' course at the College of Forestry at Stockholm, and must have practiced forestry a year on a range. Foresters or guards receive a salary of \$160. The state provides dwellings in the vicinity of the forests for officers and foresters. At the head of the forest administration is a director general, with salary of \$2,400, and having rank corresponding to that of a major general in the army;

and a chief of bureau, with salary of \$1,867 and rank corresponding to that of a lieutenant colonel in the army.

There is a continuity of forest product based upon certain plans of cultivation. Reforesting is effected partly by sowing, partly by planting, but principally by seeds from standing trees, assisted by planting. The usual method of harvesting the forest crop is, in the southern part of the country, by cutting in blocks clean; in other parts of the country by cutting trees only down to a certain size fixed by law. The total forest product of the country is sustained, and it is increasing.

PRIVATE FORESTS.

The aggregate extent of private forests is 58,715,135 acres and their average value per acre is estimated at about \$5. About twenty-five per cent of private forests is managed on forestry principles. A royal committee is preparing a project of forest laws to promote re-growth of private forests.

FORESTS OF THE UDDEHOLM COMPANY, SWEDEN.*

The forests of the Uddeholm Stock Company are situated in nine parishes in the province of Vermland and in two parishes of the province of Dalarne. Karlstad, on Lake Wenern, about fifty (English) miles distant, and Gothenberg, about one hundred and eighty miles distant, are the nearest export harbors. Lake Wenern is connected with the Baltic and also the North Sea by the Gotha and Trollhatte (canals). The company owns fifty-six miles of railroad—Nordmark-Klarelfven—with thirteen stations, which transports all sorts of goods, especially iron and lumber, to and between the works. The company owns 400,000 acres of land in Vermland and 25,000

*Information furnished in Swedish by Dr. Fredrik Loven, chief forest master, through Mr. Gust. Jansson, manager of the Munkfors Iron Works.

acres in Dalarne. About 60,000 acres have been acquired within the last ten years. Of the entire area, not exceeding 60,000 acres consist of naked tracts, fields, meadow, also unproductive surface of moss, lake and rocky elevations; while at least about 375,000 acres consist of natural forest-bearing land. Hereof perhaps 15,000 to 18,000 acres are pasture land. Pine comprises 70 per cent of the forest, and spruce 30 per cent of all trees large enough for the saw. The birch is the prevailing species within the pasture, but among the birch conifers are generally found.

The Uddeholm Company's lands lie on both sides of the Klar river along its middle course. The parish of Råmen, in Vermland, and the boundary of Dalarne terminate the extent of the property on the east and the two judicial districts of Fryksdal on the west. About 375,000 acres lie in one body. Only a very little public forest and some belonging to farmers are included therein here and there. The rocky elevations consist of primary rocks, principally granite and gneiss, with interspersed hills of hyperite. West of the Klar river red iron gneiss is almost the prevailing rock, but east of the same river granite prevails, in large part solid, not crystalline, but there are large tracts of primary granite poor in feldspar. On granite, pine prevails to the extent of 75 to 80 per cent, while on gneiss spruce occupies at least 40 per cent of the surface. On the "hyperite" hills spruce of large growth prevails. The soil in the forest is composed partly of the disintegrated rock such as above mentioned and partly of deposits of older or later water courses. Much of the soil is gravelly; much also is sandy. The Klar river within the region of the Uddeholm forest is 400 feet above the sea, and on the east and west sides rise very steep hills which at a distance, generally of a thousand yards, attain a height of from 1,000 to 1,500

feet above the sea; thereafter they take a plateau form, but are very often broken by water courses or bogs. The whole region is thereby in a large degree of that cut or broken character which one can readily obtain an illustration of by ascending one of the principal heights. The highest and only actually barren-topped mountain in the company's forest is Harfjellet, 2,200 feet above the sea. Another, Tönnet mountain, 1,700 feet above the sea, is called a "fjell" (barren-topped or snow-covered mountain), but it is not actually that, for it is partly forest-covered.

Agriculture takes a subordinate place; the land most suitable for cultivation is generally along the banks of the larger streams. About 700 persons occupy small farms as tenants and are obliged to produce certain quantities of charcoal, in general 6,600 bushels each, and in all 4,620,000 bushels. They are also obliged to transport the coal to the works. Besides, there are several hundred forest laborers with smaller premises on which one of two cows and several smaller animals are fed. About 14,000 persons live and gain their livelihood on the company's property.

About 3,000 acres (2,700 to 3,000 "tunnland"; one tunnland being equal to 1.22 acres) are consumed or cut over annually; though it is not easy to say just how much, because clean cutting and selection cutting (cutting only the larger trees) are both practiced. On an average every tunnland (1.22 acres) ought at the end of every rotation period—120 years for pine and 90 years for spruce—yield from 4,000 to 4,500 cubic feet of lumber.

The forest is handled by means of cutting trees that hinder the growth of others or which are themselves defective ("hjelp och rensningsgallringar"), and thinning to admit light ("ljushuggningar"), consisting of two to three careful timber cuttings with an interval of 15 to 20 years,

which end either by leaving seed trees or in clean cutting. The best stands of pine are finally cut at the age of from 130 to 140 years, and the middling at the age of 120 years, and the poorer at the age of 100 years. The spruce stands in which thinning is much practiced are nevertheless very sensitive to damage from excess of light, wherefore timber cutting must be undertaken with great care and skill, otherwise drought occurs. Spruce is cut at the age of 70 to 100 years, according to its quality. During the past ten years there has been cut yearly 12,000,000 cubic feet of lumber of various sorts, namely, of saw and building timber, 2,000,000 cubic feet; spruce for paper pulp, 850,000 cubic feet; telephone and telegraph poles, 125,000 cubic feet; firewood, 2,275,000 cubic feet; wood for charcoal, 6,600,000 cubic feet; miscellaneous, 150,000 cubic feet. Besides, there was each year brought to the works and consumed stub-wood to the amount of 1,500,000 cubic feet.

Certainly not more than 15, or at the highest 20, per cent of the cut-over area becomes restocked by natural seeding. The cuttings are not so large but what the by-standing trees can in an essential degree contribute to renewal, and, besides, very often 15 to 20 seed trees are left on each 1.22 acre tract. The difficulties which forest culture meets with in this locality are very stony land, spring and summer drought, spring frost, sometimes, as during the previous year, excessive rain, mossy or swampy land and land heavily pastured by cows and sheep. On the other hand, the forest area is not much troubled with heath, strong growth of grass, insects, etc. In regard to sowing, the twigs are burned immediately after the frost is out of the ground, and while the ground is damp. Generally the following year the cleared area is sown with pine and spruce seed. On pine land spruce seed is mixed to about 50 per cent. On land which is suitable

for both, 60 to 70 per cent of spruce seed is used. On pure spruce land 15 to 20 per cent of pine seed is mixed in. On cleared land, to prevent injury from drought, long, narrow seed strips—made by hatchets—are used about a yard apart, not large squares; but when heath or grass growth is to be feared then planting is to be preferred. For hacking of these seed strips are selected places which are suitable for the growth of the seeds and protection of the plants, such as the north side of shading objects,—for example, stumps, windfalls, fixed rocks, etc. The seed is laid on the south corner of the seed strip so that seed and plant will be better shaded. When sown on rocky land it has to be raked and covered by hand. On even ground the seed strips should be made in a direction from east to west, and the seeds not deep, harrowed down along the south border of the strips. On the other hand, on steep descents the seed strips should be laid horizontally, so that the seed, in case of heavy rain, shall not be washed down the hill. During the latest ten years there have been yearly about 2,400 acres sown with from 800 to 900 kilograms of conifer tree seed.

The planting of forest trees takes place on the company's land on a small scale and only where strong growth of grass hinders the growth of young forests. That is usual on good spruce land. There are planted four-year-old transplants from four to five feet apart, so that the number of plants on a tunnland (1.22 acres) varies between 2,250 and 3,500. The average number of trees standing on an acre at the time of cutting is very different, depending on previous cuttings. To more fully answer this question as to old forest on gravelly land which has not been subjected to other cuttings than the thinning of too crowded trees and cuttings of defective trees, the number of trees on two tracts, each of two and a half acres extent, have been counted with the following

result: First tract, average pine land, pure stand of pine; average age, 135 years; average height, 85 feet; diameter measured 5 feet from ground. There were found 8 trees with diameter of 5 inches, 13 of 6 inches, 20 of 7 inches, 27 of 8 inches, 34 of 9 inches, 42 of 10 inches, 44 of 11 inches, 44 of 12 inches, 53 of 13 inches, 40 of 14 inches, 30 of 15 inches, 16 of 16 inches, 11 of 17 inches, 3 of 18 inches, 2 of 19 inches; total, 385 trees, containing 9,178 cubic feet. Second tract, good pine land; young spruce successively grown up; pine of average age of 130 years and average height 85 feet; there were found 3 pines and 37 spruces 5 inches in diameter, 44 pines and 58 spruces 6 inches, 61 pines and 37 spruces 7 inches, 77 pines and 28 spruces 8 inches, 76 pines and 11 spruces 9 inches, 82 pines and 7 spruces 10 inches, 83 pines and 6 spruces 11 inches, 73 pines and 3 spruces 12 inches, 53 pines and 1 spruce 13 inches, 30 pines 14 inches, 14 pines 15 inches, 9 pines 16 inches, 5 pines 17 inches, 1 pine 19 inches, 2 pines 20 inches (in diameter); total, 613 pines and 188 spruces, in all 12,013 cubic feet.

Thus were found about 300 trees left per "tunnland" of about 5,300 cubic feet, which, according to an average age of 133 years, shows a yearly average growth of 40 cubic feet per "tunnland" (1.22 acres). If, on the other hand, timber cutting is done once or twice before the final cutting, as is usual, the number of trees at the last is much less. To prevent forest fires, during very dry weather, strict watch is kept by 30 forest guards and by extra ones, and in addition all of the company's dependents are obliged, when a forest fire breaks out, to send notice to the forest guard or forest manager and assist in extinguishing it. Generally the precautions are effective in preventing such fires. No forest fire worthy of mention has occurred in twenty years.

The company's land has been used for forest more than

100 years. It cannot be said what the net revenue is per acre, as the greater part of the product is used at the works in form of coal or fuel. The average yearly growth per "tunnland" ought to be 40 cubic feet, of which one fourth, or 10 cubic feet, should be saw timber of the net value of 1.50 kronor; 10 cubic feet of building timber, worth 1 kronor; 20 cubic feet of wood, worth 0.70 kronor, or, for the 40 cubic feet, 3.20 kronor (equal to \$0.85).

The income from game is not large. There are shot annually 12 elks, many hares and game birds.

SWITZERLAND.

The Swiss Confederation is composed of twenty-two cantons, which are separate and sovereign states; and while each canton has legislative authority over forests, the Confederation also exercises legislative authority over them in certain regards. Under article 24, of the Federal Constitution of May 29, 1894, the Confederation controls only the forests of the high regions, which are about 65 per cent of the total forest area of Switzerland. It is true that since the popular vote of July 11, 1897, which revises the said article 24, the Confederation has from now on the right of inspection of the forest police of the whole of Switzerland.

The federal law of March 24, 1876, which puts into execution the above-named article 24 of the constitution, was promulgated for the forests of the high regions. By the terms of that law the inspection by the Confederation extends over the entire territory of the cantons of Uri, Schwytz, Unterwald, Glaris, Appenzell, Grisons, Tessin and Valais and over the mountainous parts of the cantonal territories of Zurich, Berne, Luzerne, Zoug, Friburg, St. Gall, Jura and Vaud; but the law does not apply to the forests of the plains of the last mentioned

states, nor to the forests of the cantons of Soleure, Bale, Schaffhouse, Argovia, Thurgovia, Neufchatel and Geneva.

The Confederation is not actually the owner of any forests, but a few of the separate states are owners. The forest domains are part of the national wealth, and comprise 91,587 acres. There are also in the cantons the forests of the municipalities and of the corporations, comprising 1,403,772 acres. Besides there are private forests, comprising 609,855 acres. The total area of forests is therefore 2,105,220 acres, or about 20 per cent of the total area of Switzerland.

Forests are found everywhere in Switzerland. The parts most heavily timbered are the mountain chains of Jura and of the cantons of Schaffhouse, Soleure, Argovie and Neufchatel. Forests are found starting at 200 meters above sea level (in the canton of Tessin) and reach as high as 2,100 meters in the high mountains. In Argovia they even reach 2,300 meters in altitude.

The more common varieties of trees are among the resinous kinds, the opicea, the fir, the larch, the Scotch and mountain pines, the Siberian pine; among the deciduous kinds, the birch and the chestnut tree; this last kind grows especially in the canton of Tessin.

The value of forest land varies greatly and depends on the location, the nature of the soil, thickness of the settlements, the increase of these settlements and on the trade in timber and other products of the forest. The value per hectare ($2\frac{1}{2}$ acres) may range accordingly from 300 francs to 6,000 francs.

In regard to expenses of administration, a distinction must be made between the expenses incurred by the Confederation and those incurred by the cantons. In 1897 the expenses incurred by the Confederation for forest administration amounted to \$56,000.

The following are the net receipts from forests in 1896 as to a few cantons :

Zurich, 180,900 francs, or 91.06 francs per hectare of forest.

Berne, 893,000 francs, or 71 francs per hectare of forest.

Soleure, 33,400 francs, or 44 francs per hectare of forest.

St. Gall, 71,000 francs, or 84.60 francs per hectare of forest.

Argovie, 241,000 francs, or 78.73 francs per hectare of forest.

Vaud, 236,000 francs, or 32 francs per hectare of forest.

The net receipts from town and municipal corporation forests in 1896 were :

Canton of Grisons, 1,200,000 francs, or 10.40 francs per hectare of forest.

Canton of Argovie, 2,378,000 francs, or 70.60 francs per hectare of forest.

On an average about 412 acres of forest have been created annually during the past twenty years, at the expense of the federal treasury.

In order to regenerate the forests, both planting and natural seeding are practiced, as may be most effective.

In the lowest countries, where clean cutting is practiced, planting is resorted to. Where real dangers exist from avalanches, land-sliding, etc., which do not permit complete denudation, and where gardening is required, natural modes of regeneration are generally used, and sowing is seldom done.

Reforestation by the Confederation in high mountain regions costs on an average 400 francs per hectare for 6,000 to 7,000 plants set in their places.

The federal and cantonal legislatures prescribe a sustained production for the forests of the state, of the towns and of the municipal corporations. If, through winds, snow-slidings or otherwise, too much timber has been destroyed, less cutting is done in the following years, in order that as rapidly as possible the forest may regain the number of trees fixed by the management. The forests are operated in various ways, according to localities and ac-

cording to the size of timber that is to be grown, viz., high forest, under-growth and coppice.

In accordance with the terms of the federal law, the forest area cannot be reduced. The cleared land must consequently be reforested except in cases where an equal area of land is covered into forest. Furthermore, the cantons as well as the Confederation have the right to compel the creation of protective forests wherever they are needed for public utility.

Forest fires seldom occur. Of those which do occur the principal causes are carelessness in lighting fires in the immediate vicinity of the forests, and lack of care in the woods. It is rare that a forest fire is occasioned by locomotives.

The administration charged to execute the federal forest law is the Federal Inspectorate of Forests, forming a part of the Swiss federal department of the interior. Nearly all the cantons have for their territories a forest administration. In the small states one single technical official is at the head of the service, but in the larger cantons the administration is under the direction of one or more chief forest inspectors or chiefs of the service and of several district foresters or forest inspectors. An inferior personnel instructed for the federal zone in courses lasting two months is attached to this technical personnel, and is organized to execute the work of forest economy.

A few cities or towns with extended and important forests have also a self forest administration, at the head of which is a person of technical forest training. Among them are Zurich, Berne, Lausanne, St. Gall, Winterhues, Friburg, Coire, Soleure, Schaffhouse.

The Chief Federal Inspector of Forests has an annual salary of 8,000 francs and fees of eight francs per day, and eight francs per night, when he has to be absent, for his service; he gets his traveling expenses reimbursed,

his first assistant has a salary of 6,400 francs and is similarly indemnified for his inspection trips.

The three inspectors of the canton of Berne receive each 5,300 francs per annum. They receive extra pay, six francs per day and four francs per night, for all inspections made outside of their city, and their traveling expenses are reimbursed.

The high forester or chief inspector of the canton of St. Gall, who has a salary of 5,000 francs, receives ten francs per day and four francs per night, besides his traveling expenses, when out inspecting.

The Federal Inspectorate of Forests publishes every year a report on its management. The majority of the cantonal inspectors do likewise.

In the matter of taxes, the cantons are sovereign in their own limits. Taxation therefore differs according to the cantonal territory to which it applies. In all these states a tax on the forest is imposed, and in most states that tax is combined with the tax on income. But for one and the same forest only one of these two modes of taxation is generally applied. A few examples will show: In the canton of St. Gall the state has paid to the towns in which it has forests a tax of 1.20 francs per hectare. In Argovie the state pays to the towns where its forests are situated a tax of 2.40 to 3.20 francs per 1,000 francs of forest value. On the other hand, the towns only pay to the state a tax of 40 centimes per 1,000 francs of forest value. The private forest proprietor pays to the state 40 centimes and from 2.40 francs to 3.20 francs to the towns per 1,000 francs of forest value; and in addition thereto he is taxed on the income in the amount of one per cent of the average two per cent of gross declared value of the forest, but neither the state nor the towns pay a tax on the income of their forests.



Young white pine on the U. S. Forest Reserve, southeast shore of Pike Bay. Photographed July, 1902, for the Annual Report of the Chief Forest Fire Warden of Minnesota.

WURTEMBERG.

Wurtemberg lies west of Bavaria, and is the third German state in point of area, its population being a little over 2,000,000. Its greatest length from north to south is 140 miles, and its greatest breadth is 100 miles. One-third of the Black Forest (so called from the dark foliage of its pines), and which forms a sort of a triangle, lies within Wurtemberg, two-thirds being in Baden. The Black Forest has a total length of 93 miles, and its breadth varies from 13 to 46 miles.

STATE FORESTS.

The aggregate extent of the state forests is 418,904 acres, and they extend over the entire kingdom. Fifty-nine per cent of the forests consists of pine, 20 per cent being pitch pine and 9 per cent white pine. The estimated value of the forest land varies from \$29 to \$58 per acre. The annual aggregate expense of administration of the forest amounts to \$1,183,574. Of this \$364,140 is paid to wood-cutters, \$147,560 is expended on roads, \$90,440 in forest culture, \$259,468 for pay of officials, \$148,468 for forest guards. The revenue was \$2,928,352, yielding a net revenue, after for 1895-1896 deducting all expenditures, of \$1,744,788, or \$3.63 per acre. The number of acres annually sown to forest is 296, and the number of acres planted to forest 6,177.

In regard to reforestation, when the natural seeding of the desired kind of wood occurs in proper time the same is used; otherwise planting or artificial growing takes place. Natural sowing is estimated at about 25 per cent; artificial renewing amounts to about 75 per cent. The latter is almost exclusively done by planting, whereas sowing in free woodland is very seldom applied. It is a principle to maintain (as far as the division of the age of the plantings

permit) an equal annual cutting. At present the cutting is fixed at 1.94 cubic meters per acre. The cutting is contracted for with laborers living in the neighborhood of the woods. By good management there are at a given plot generally trees of about the same age. If the natural seed falling is intended to be used, the larger trees, either single or in crops, are cut out in a direction against the prevailing winds; the remaining trees are thinned and gradually cut out as the growing young trees may demand. If the natural seed falling is not taken into consideration, the wood crop is cut clean in narrow strips, also in a direction against the prevailing winds, and the cutting of the second and following strips is postponed until the young plantings can dispense with the side protection of the old woods. It is a principle that replanting follows immediately after the cuttings. Moreover, the state buys every year about 400 acres of woodland to increase and round off the forests.

The amount of damage annually caused by forest fires is only \$642.60, and the principal cause of such fires is carelessness and negligence while smoking and lighting fires in or near the forests. In the last ten years, out of 120 forest fires only 8 were caused by sparks from locomotives, and of these only one caused considerable damage (about \$3,570).

In regard to the rank in the forest service, as compared with other branches of the public service, it may be said that the forest officials rank in general equally with those state officials who are graduates of the university. The Department of Forests is directed by one president, four technical and four administrative members and one commander of the forest guards. The salary of the president is \$1,844.50 per year; the salary of the members of the Board of Direction is from \$1,190 to \$1,618. A work entitled "The Forests of Wurtemberg," published by

Rueger, Stuttgart, 1880, gives a fair review of the situation of the forestry of the country. It may here be stated that in respect to net revenue Saxony and Wurtemberg stand at the head of forest administration and forest culture in general.

PRIVATE FORESTS.

The aggregate extent of private forests is 528,794 acres, of which 210,000 acres are administered by technical forest officials; the remainder is also administered in a proper manner. As the permission of the government is required for cutting and replanting of forest lands, and this permission is only given under the condition that an equal area to what has been cut shall be planted, the aggregate area of forest land remains the same throughout the whole country; but portions of it are gradually coming into the possession of the state government.

FREDERICK THE GREAT, THE FATHER OF GERMAN FORESTRY.

Frederick the Great promulgated laws in 1740 and 1754 for regulating the cutting of wood, which previously had been done as everyone pleased, without any regard to replanting. In place of such improvident practice he established rotations of 70 years; that is, he provided that forests should have 70 years in which to mature before being cut, also prescribed methods of thinning so that the young and healthy growth of oak and beech would be better protected. Later instructions were issued in 1764, 1770, 1780, 1783. In addition to this he instituted communal forests under the care of wardens, forbade private owners from every wasteful cutting and placed under the care of the state a portion of the forests in Silisia which previously

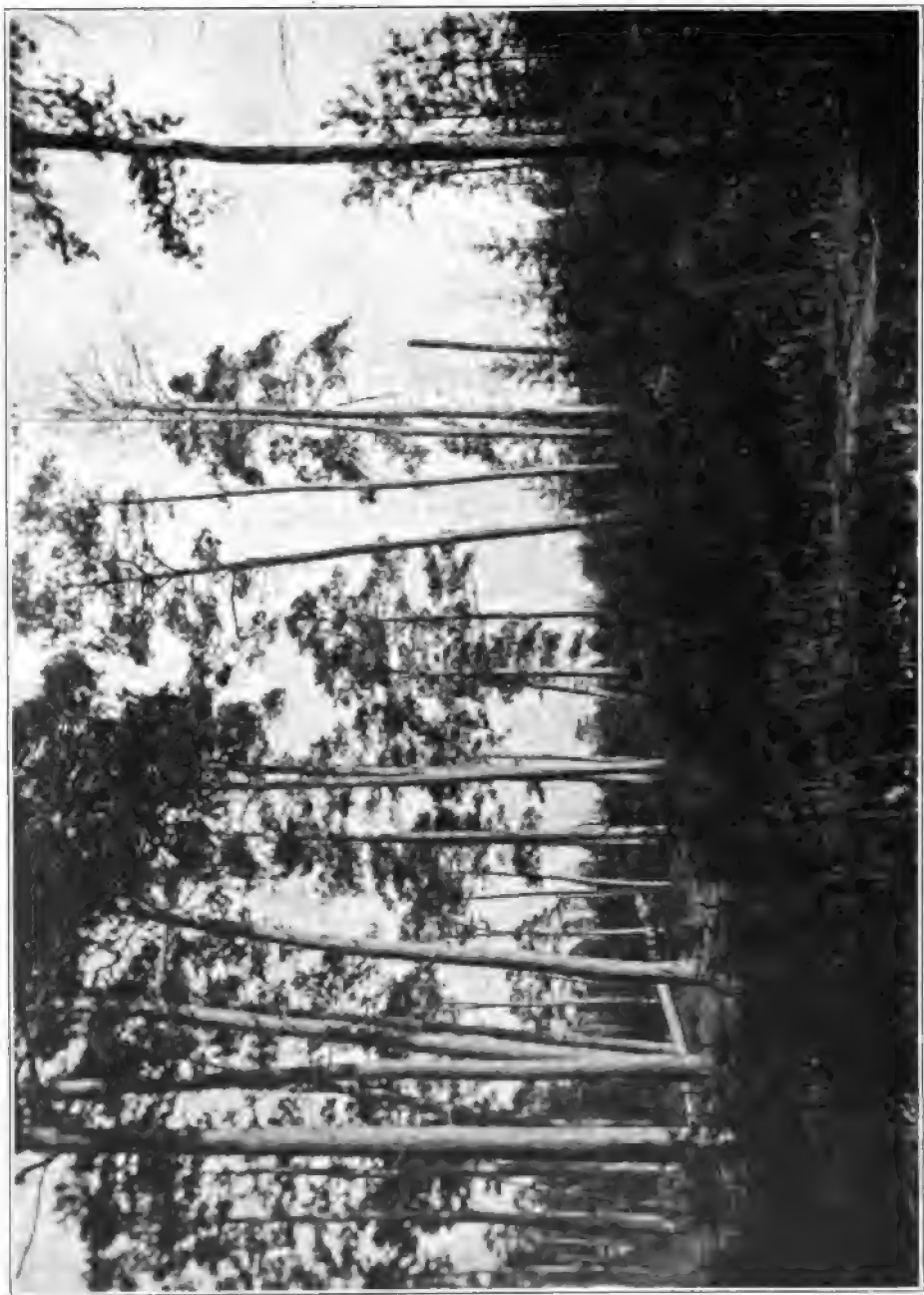
had belonged to private parties. Frederick the Great ordered the division of the national forests into compartments or blocks, each of which was to acquire the age of 70 years before being cut. But inasmuch as it was found that 70 years were not sufficient for the proper growth of the trees, each of these main compartments were subdivided into two compartments, so that a period of growth running 140 years was established.

There had been, in more ancient times, laws relating to forests for certain parts of Prussia, the first dating 1547. These related to the right of using the forest and necessity of replanting, more than to general systematic care. One can therefore properly claim that Frederick the Great is the father of the German forests, as it was he who created the existing forestry laws and made them apply to private as well as to state forests.

THE WORKING PLAN.

The "Manual of Forestry" in five volumes, by Dr. William Schlich, principal professor of forestry at the Royal Indian Engineering College, Cooper's Hill, England, and formerly Inspector General of Forests to the Government of India, is the best work on the subject in the English language. Dr. Schlich has kindly given me permission to copy from his third volume an account of the "working plan" as used in forestry, and what follows on that subject is taken from that volume.

Forest working plans regulate, according to time and locality, the management of forests in such a manner that the objects of the industry are as fully as possible realized. The working plan for a protection forest, or a park-like forest, is altogether different from that of a forest which



Norway and young Jack Pine on Chippewa Forest Reserve. Photographed for the Annual Report of the Chief Forest Fire Warden of Minnesota
July, 1902.

is managed on economic principles. The latter is the kind with which we have here to do.

The working plan report is a document which gives necessary information and which describes the system of management in such detail as may be required in each case. For forests which are of great value, and which yield high returns, very detailed plans should be drawn up; for forests which give as yet only small returns, simple plans would be indicated.

WORKING PLAN REPORT.

INTRODUCTION.

I.—GENERAL DESCRIPTION.

1. Name and situation of forest; name of proprietor.
2. Boundaries.
3. Area.
4. Configuration of the ground.
5. Rock and general character of the soil.
6. Climate.
7. Legal position of forest, rights and privileges.
8. Surrounding population and its requirements.
9. Markets, lines of export.
10. Prices of the several classes of produce.
11. Cost of extraction and of transport to markets; supply of labor.
12. General description of forest growth.
13. Injuries to which the crop is exposed.
14. Rate of growth.
15. Yield tables, volume tables, form factors, reducing co-efficients, etc., used in the calculation of the volume and increment of the woods.
16. Organization and strength of the forest staff.

II.—DETAILED DESCRIPTION OF COMPARTMENTS.

III.—DIVISION AND ALLOTMENT OF AREAS.

IV.—DESCRIPTION OF THE METHOD OF TREATMENT.

- 1. The objects of management.
- 2. Choice of species.
- 3. Choice of silvicultural system.
- 4. Determination of the rotation.
- 5. General lines of treatment.
- 6. General lines of yield.

V.—SPECIAL WORKING PLANS.

- 1. Plans of utilization.
 - a. Final cuttings.
 - b. Intermediate cuttings.
 - c. Minor produce.
- 2. Plan of formation.
- 3. Plan of other works.
- 4. Maps illustrating the condition of the forest and the proposed treatment.

VI.—MISCELLANEOUS.

- 1. Reorganization of the forest staff.
- 2. Financial forecast.
- 3. Proposals for the control of the execution of the working plan.
- 4. Miscellaneous observations.

WORKING PLAN FOR A PORTION OF THE STATE FORESTS OF
THE HERRENWIES RANGE IN THE BLACK FOREST,
GRAND DUCHY OF BADEN.

PERIOD 1884—1893.

WITH THE RESULTS OF THE ACTUAL WORKING.

GENERAL DESCRIPTION.

1. *Area and Boundaries.*

The areas are recorded as follows:

(a) Productive area	1,747 acres
(b) Unproductive area	nil. "
(c) Other areas, including fields, meadows, etc.	2 "

Total area = 1,749 acres

Alterations in the above figures will probably become necessary when a fresh survey is made.

The outer boundaries are in order, but the internal boundaries require rectification.

2. *Locality.*

The forest here in question occupies on the whole the slopes lying between a hill range on the south and the river Schwarzenbach on the north. The highest point of the hill range, the Hoher Ochsenkopf, has an elevation of 3,465 feet above the sea, while the lowest part, near the Schwarzenbach, is only 2,000 feet above the sea, the mean elevation being placed at 2,600 feet.

The slopes, on which the forest is found, are mostly steep, level spots being only found on the summits of the hills, and toward the lower end, where granite and Bunter Sandstein meet.

The area is drained by the Schwarzenbach (a feeder of the Raumünzach) with its two feeders, the Gartenbach and Dobelbach. The first mentioned runs from west to east, and the two latter, more or less, from south-west toward north-east. It follows that the forest in the valley of the Schwarzenbach has generally a north aspect, and in the valleys of the Gartenbach and Dobelbach a northwest aspect on one side, and a southeast aspect on the other side of the streams. All the forest areas (except those situated at the highest elevations and which are of no importance) are protected by intervening ranges against the prevailing winds.

Up to a mean elevation of 2,500 feet, granite is the principal rock, which is sometimes (though rarely) pierced by porphyry. Above the afore-mentioned elevation the granite underlies upper Bunter Sandstein (Vogesen Sandstein), and the latter accordingly prevails in the larger part of the forest area.

The granite is generally rich in orthoclase and oligoclase, and therefore decomposes readily, and furnishes mostly a deep soil rich in mineral elements. The decomposition is facilitated, and the quality of the soil improved, by the remarkably numerous springs which appear between the granite and the Bunter Sandstein. Hard slow decomposing quartzite is of rare occurrence.

The Bunter Sandstein is characterized by rapidly and greatly changing mineral composition, consisting sometimes of readily decomposing rock yielding a deep clay soil, in other cases of hard quartz-gravel, frequently found on the surface in the numerous bolder-drifts. The Bunter Sandstein has numerous rents and fissures in all directions, so that it is rapidly drained, and the disintegration and decomposition are only rarely assisted by springs, which at the best are scanty and intermittent. It follows that the Bunter Sandstein soils, even when formed by the easily decomposed and minerally rich clay sandstone, never equal the best quality of the granite soil; moreover, they change frequently and very suddenly, and without any visible cause, into almost unproductive areas.

On the flat hill tops, layers of fine white sand (produced by the disintegration of the gravelly sandstone) frequently produces an impermeable stratum, preventing the water from percolating, thus causing bogs (or "Gründe") which often extend over considerable areas and are almost unproductive.

The quality of the soil, therefore, ranges between good and unproductive, in the following proportion:

Good and fairly good to medium	= 78 per cent.
Medium to indifferent	= 12 "
Indifferent to unproductive	= 10 "

The climate is rough, and is characterized by long winters with an abundant snowfall, and by rapid changes of temperature; at the same time it is throughout favorable for forest vegetation, especially for conifers.

3. *Species.*

The details will be found in the description of compartments. Generally speaking, the spruce and silver fir are the prevailing trees, the former being more abundant in the middle and upper parts, the latter at the lower elevations. The beech is associated with them locally and in varying proportions. Scotch pine is found in the granite region chiefly upon dry, steep, rocky slopes with a southerly aspect, and in the sandstone region, especially on dry ridges and the top of the mountains, as well as here and there in other localities. The three conifers attain a maximum height of 140 feet, with regular shaped and little tapering stems. Toward the upper limit of the area the height growth diminishes rapidly, dwindling down to 20 or even 15 feet on the high plateaux. Here the mountain pine and the birch are also found. Reproduction is generally good, except at the higher elevations. A marked difference is found between northern and southern slopes, the growth and reproduction being far more vigorous on the former than on the latter.

The silver fir is much exposed to cancer. Windfalls and snow breakage are fairly moderate, while the damage from insect attacks is very small. During the years 1874-83, the following proportion existed between the different classes of fellings:

Cuttings caused by insect attacks	=	1	per cent of total fellings.
" " snow breaks	=	12	" " "
" " windfalls	=	16	" " "
Cancer and other diseases and injury	=	19	" " "
Other cuttings	=	52	" " "
<hr/>			
Total	=	100	" " "

4. *Method of Treatment and Rotation.*

The situation and the species necessitate the area being treated under the high forest system. The quality gradations, as indicated under 2, are so conspicuous locally that it is possible (as well as desirable in order to secure a proper idea of the condition of the forest), to group the growing stock according to its characteristics as produced by the quality of the locality, and according to the method of treatment thereby indicated. The actual basis of this grouping is the yield, and based upon it, the net income or financial result of the management. In this sense the forest may be divided into the following three groups:

a. Areas Subjected to an Intensive Management.—To this group belong all areas which, in virtue of their quality (as indicated mainly by the height growth of the trees on fully stocked areas) are capable of producing large timber; areas on which carefully conducted regeneration fellings will produce natural regeneration within a reasonable period of time, and where the cost of any artificial assistance in regeneration is commensurate with the anticipated returns. As lowest limit of this group a normal increment of 43 cubic feet per year and acre, calculated for a rotation of 120 years, has been fixed. The area thus included in the group amounts to 78 per cent of the whole. It is with this area, and the growing stock standing on it, that the management must more especially reckon, and from which the

largest possible sustained yield must be secured. With a suitable composition of the growing stock and a careful application of silvicultural principles, that object may be obtained under an average rotation of 120 years.

As regards the silvicultural treatment, and especially the regeneration of the woods, two different classes of forest or growing stock (corresponding with two qualities of locality) stand out prominently.

First: Forest of spruce with a strong admixture of silver fir (the latter occasionally predominating) more or less frequently interspersed with beech and more rarely with Scotch pine.

Secondly: Forest in which spruce predominates with a slight admixture of silver fir and here and there of Scotch pine, but devoid of beech.

The first class of forest occurs in the granite area and on those parts of the Bunter Sandstein (clay sandstone), which have deep, easily decomposed soils fit to be classed as good. The characteristic features of this class of forest are the occurrence of beech and deep soils, rarely covered with boulders or debris, lying mostly at the lower elevations; natural regeneration can here be successfully effected in a comparatively short period of time.

The second class of forest occupies the stony slopes of the Bunter Sandstein area, and in exceptional cases the quartzite parts of the granite area. Here the soil is generally covered with loose boulders and rock debris of varying size. These areas are nearly all found at the middle to upper elevations. The conditions described demand the maintenance of an uninterrupted canopy up to the age of maturity, and a careful execution of the regeneration cuttings spread over a prolonged period of time, or else weeds will spring up, which make regeneration very difficult, and at any rate expensive.

On the whole, however, careful management is sure to be successful in securing natural regeneration in all the areas pertaining to this group; for this purpose, as well as for the production of valuable timber, a rotation of 120 years on an average is considered of sufficient length. The length of the regeneration period differs considerably in the different parts, varying on the whole from 30 to 50 years.

b. The second group consists of woods growing on soils, which, even under the most careful management, cannot be expected to produce trees of first or even second quality. The trees here produced are of such limited height growth, that the production of valuable timber is out of the question. The woods are found in the upper, and here and there in the lower part of the Bunter Sandstein area, where the soil is covered with large masses of the debris of gravelly sandstone, which is not easily decomposed, and where the slightest interruption of the canopy overhead is followed by the appearance of a dense growth of bilberry and heather.

Nevertheless, these areas are capable of yielding timber of the inferior classes, as well as firewood, and the returns which may reasonably be expected from them, justify the application of a method of treatment which, while avoiding any interruption in the canopy and all expensive cultural operations, facilitates natural regeneration; in other words the treatment under the selection system by removing all trees which are deteriorating or incapable of increasing in value. It is difficult to fix any definite rotation, but it is estimated that the trees will take about 150 years to reach maturity.

The lowest quality limit for this group has been fixed at 7 cubic feet increment per acre and year, while the upper limit is, as already indicated, 43 cubic feet. The area comprised in this group amounts to 12 per cent of the total area.

c. The third group comprises the so-called "Grinden," that is to say the highest parts of the ridges, which are mostly level and have a tendency to boggi-ness. They are covered by a dense growth of bilberry and heather, and are incapable of producing more than a stunted tree growth, which yields only a scanty quantity of firewood, frequently not covering the price of preparing it; hence financial considerations are entirely out of the question, the areas being protected merely for the sake of preserving some cover on the hill tops. The group comprises all parts which produce an annual increment per acre of 7 cubic feet and under; they amount to 10 per cent of the total area.

In so far as the management aims at the production of valuable material, and at favorable financial results as regards outlay for artificial regeneration (where natural regeneration has failed), for improvement, tending, etc., only the areas in the first group can be considered. But in the treatment of those forests which pertain to the principal mountain region of the Black Forest, representing a certain drainage area, the task of forestry goes beyond mere financial considerations. It has in fact been recognized that it is necessary to keep areas of this class well wooded for the sake of a proper husbanding of the water supply in the streams. Accepting this further task, the forest administration has endeavored, during the last 50 years, to afforest the poorly stocked and frequently entirely bare areas at the higher elevations of the Bunter Sandstein region. In so far as the cultural operations were confined to the boulder drifts of the Bunter Sandstein, they were moderately successful, but the cultural attempts made in the "Grinden" prior to 1870 turned out failures. Since 1873 the cultural operations in the Grinden present a more hopeful aspect, owing to the experience gained by former failures, and it seems desirable to continue them in the future.

The working plan deals in detail only with the forest area subjected to intensive management, but the group worked under the selection system has also been adequately noticed in the general provisions.

The working plan lays special stress upon the execution of improvement felling, more particularly the removal of cancerous silver firs. For this purpose the ordinary thinnings are utilized; but over and above these, cancerous trees must also be removed from the old woods, where otherwise no further thinnings would be required. In regeneration felling the trees to fall first under the axe must be those attacked by cancer. Even then not nearly all cancerous trees can be removed during the next ten years. This fact teaches the management that in future a sharp attack must be made on all cancerous trees at the time of the first and second thinnings, even if a temporary interruption of the canopy should thereby be caused. On the rich deep soils of the granite area, which are almost exclusively concerned in these remarks, even an interruption of the canopy extending over a somewhat lengthy period would not be a misfortune, and preferable to the maintenance of a full canopy consisting to a considerable extent of cancerous trees. The existence of enormous quantities of such trees on the granite area was one of the reasons which led to the yield being fixed at its present rate.

5. *Utilization.*

a. Yield of Major Produce.—The actual yield during the last 40 years has been as follows:

Compartment.	YIELD, IN SOLID CUBIC FEET.					Area in Acres.
	1844-53.	1854-63.	1864-73.	1874-83.	Total.	
1. Schwarzenbronn....	218,886	122,860	149,848	79,141	569,535	65
2. Schwarzenberg.....	811,518	158,778	200,788	158,955	830,039	211
3. Riesenkopf.....	12,502	47,398	206,242	65,617	331,559	76
4. Mehliskopf.....	.....	.....	.....	.....	.....	84
5. Grünwinkel.....	19,742	124,639	57,428	202,252	404,046	202
6. Dobelbach.....	26,875	42,697	80,195	69,952	169,692	178
7. Hoher Ochsenkopf..	.....	.....	.....	.....	.....	101
8. Kleingartenkopf....	84,256	2,381	1,448	1,024	89,059	76
9. Kleingarten.....	375,687	188,825	256,608	195,578	906,698	868
10. Grossgarten.....	62,544	46,668	26,417	59,118	194,767	175
11. Sachsenbronn.....	84,927	47,788	111,851	106,194	300,255	95
12. Gartenbach.....	86,811	88,645	404,665	156,412	626,733	172
	1,178,198	814,738	1,584,920	1,094,216	4,622,067	1,747
Average per year.....	117,820	81,478	158,462	109,422	115,552	.....
Average per year and acre.....	67.44	46.64	87.86	62.68	66.14	.....

From the appended statistical table it will be seen that the estimated increment of the next ten years amounts to 1,086,130 cubic feet.

The actual growing stock amounts to 9,488,731 cubic feet

The normal " " 7,892,160 "

The surplus of " " 1,596,571 "

The surplus of growing stock is due to a surplus of woods over 100 years old. With favorable prices for timber, the removal of this surplus in the shortest possible time would be advisable, so as to prevent loss of increment, and take unnecessary capital out of the forest, but as prices run low at present, it appears judicious to keep the greater part of it over for a while.

A consideration of the several compartments showed that the removal of the following material during the next ten years is advisable on sylvicultural grounds:

Final cuttings	1,146,000 cubic feet
Intermediate cuttings	154,000 "
Total	1,300,000 "

As this amount exceeds the expected increment by 213,870 cubic feet, equal to about one-seventh of the surplus of growing stocks, the yield has been fixed at 1,300,000 cubic feet, or annually:—

Final cuttings	114,600 cubic feet
Intermediate cuttings	15,400 "
Total	130,000 "

If in the course of the 10 years prices should rise, there would be no objection to reduce the surplus of growing stock further by additional cuttings.

The disposal of the yield is effected as follows:

- 1) Free grant to the Roman Catholic Priest at Herrenwies, = 1,500 cubic feet.
 " " " School " = 1,000 "
 (2) Sale by public auction and occasionally by private sale, = 127,500 "
 Total annual disposals 130,000 "

b. Minor Produce.—The principal items are forest pasture and the removal of litter, the utilization of which is permitted to the Herrenwies settlers, as a privilege.

According to government orders the privilege of forest pasture may be exercised only to such extent as the condition of the forest and the requirements of regeneration may permit. The district forest officer indicates from time to time the localities in which the privilege may be exercised. The privilege of removing litter free of charge is exercised under the same conditions. The exercise of these privileges is nowhere injurious, and may be continued during the next ten years.

The grass growing in blanks, on roads and in plantations has hitherto been sold for the benefit of the State, and, under suitable supervision, the practice may be continued.

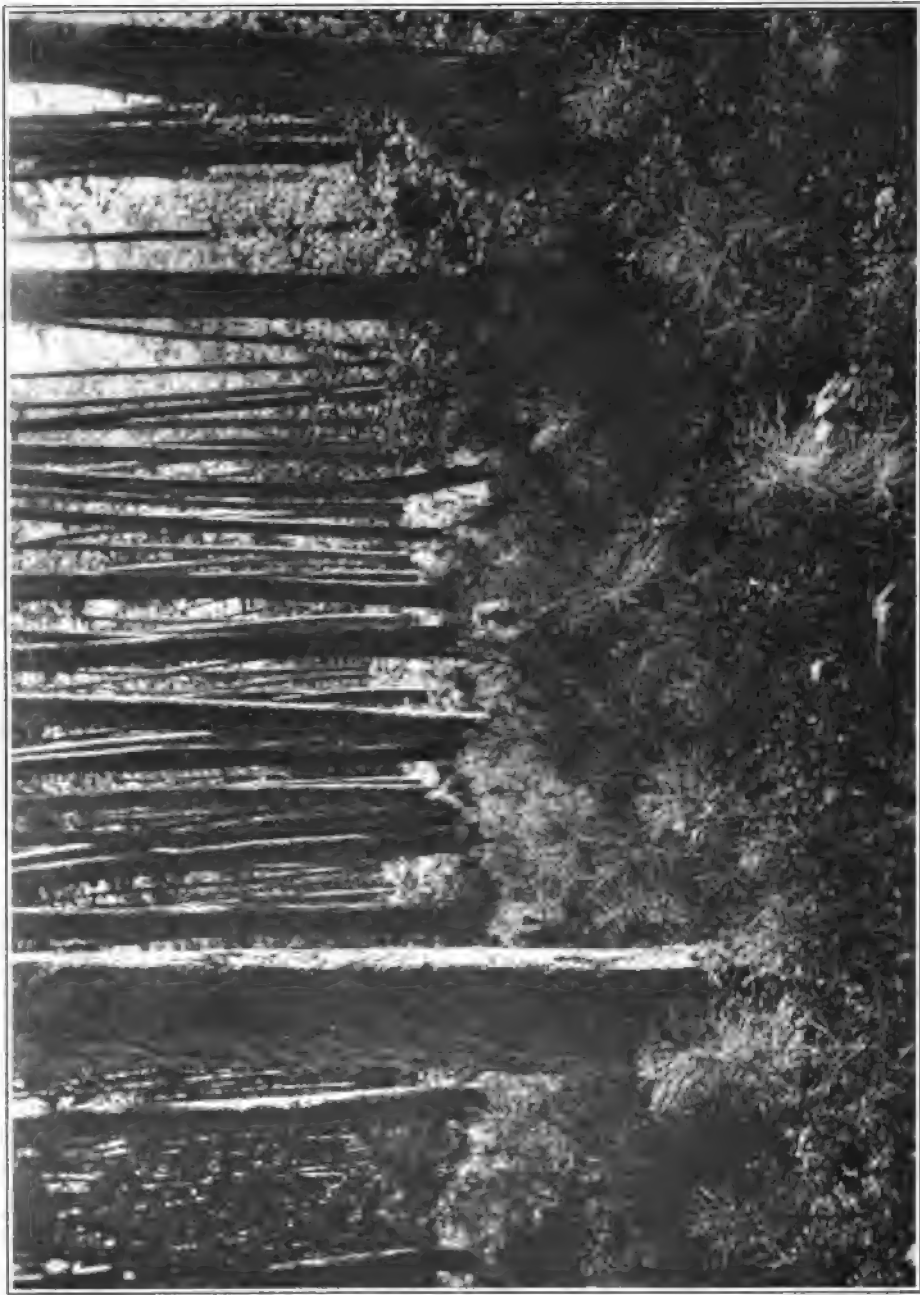
The removal of building stones, the sale of plants, etc., is insignificant.

6. Division into Compartments.

The contemplated new division into compartments must be postponed until the projected road system has been completed.

DESCRIPTION OF COMPARTMENTS.

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
<i>I. Ochsenköpfe.</i>			
Schwarzenbronn	1	65	Spruce with silver fir, some beech, Scotch pine, larch. About $\frac{3}{4}$ of area 80—90 years old, some trees older. About $\frac{1}{4}$ of area 10—20 years old. Above the road fairly complete stocking; in youngest parts still suffering from frost; below road still some blanks caused by late cutting out of old trees; in the latter part still 120—150 years old spruce and silver fir in the final stage; these show a decreasing increment. Growth on the whole fairly good.
Schwarzenberg	2	211	$a = 180$ acres; 15—40 years old spruce and silver fir with some Scotch pine and beech; some lately planted, younger, a few up to 60 years old. About 25 acres planted. Where the shelter wood has been removed, stocking generally complete, in the rest still patchy with patches of bilberry intervening. Growth generally between good and fairly good; along Herrenwies meadows partly only fair, the spruce still suffering from frost. In the north-western part, below the road, on the Riesenkopf road, and in the south-east along Dobelbach, on about 37 acres 110—140 years old spruce and silver firs of decreasing increment are standing in the final stage.



Young and mature Norway (red) pine on island in Cass Lake. Photographed by Mr. A. B. Herrell for the Annual Report of the Chief Forest Fire Warden of Minnesota July, 1902.

DESCRIPTION OF COMPARTMENTS—*Continued.*

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
Riesenkopf.....	3	76	<p><i>b</i> — 81 acres (in three parts), spruce and silver fir with a few beech and Scotch pine, generally 80—75 years old, but some small groups only 80—60 years old; generally well stocked, here and there somewhat thin and patchy. Growth between good and fairly good. On 8 acres on the Dobelbach, 80—60 years old spruce, cover complete and growth good.</p> <p><i>a</i> — 47 acres; 100—180 years old spruce and silver fir, some older; on the whole cover fairly complete; toward compartment Schwarzenberg somewhat thin, but on about 10 acres with a fair young crop of silver fir and spruce up to 15 years old. Growth fairly good, on the higher part inferior. About 6 acres along the road is a windfall area, now stocked with some silver fir and spruce growth.</p> <p><i>b</i> — 24 acres; 9—20 years old spruce (a few older), with some Scotch pine and larch, mostly well stocked, showing good to fairly good growth.</p> <p><i>c</i> — 5 acres; Grinde, in upper part heather covered, with 100 and more years old short and stunted Scotch pine, some spruce and mountain pine. On the whole poorly stocked. Part underplanted with 80—40 years old spruce, which show very poor growth.</p>
Mehliskopf.....	4	84	<p>50—90 years old (and more), mountain pine with some spruce, Scotch pine, birch and mountain ash; toward compartments 8 and 5 cover fairly complete, in the southern and south-western parts interrupted by larger and smaller areas of heather. Growth inferior.</p>
Grünwinkel.....	5	208	<p><i>a</i> — 186 acres; 110—150 years old, some older, spruce and silver fir, some beech with a few Scotch pine. In irregular final and seeding stage, in the southern part cover still fairly complete in strips. On .4 of the area stocked with up to 80 years old silver fir and spruce and a few beech. Growth of old trees still fairly good; on some stony ridges (about 7 acres) middling and inferior; young growth mostly only middling.</p> <p><i>b</i> — 16 acres on the highest part in the south and west, Grinde; heather-ground with 100 and more years old crippled Scotch pine, spruce, some mountain pine and birch; in some parts up to 60 years old advance growth thinly stocked. Here and there traces of plantings, 24 years old spruce.</p>
Dobelbach.....	6	178	<p><i>a</i> — 138 acres; 100—180 years old, some up to 200 years, spruce and silver fir, some Scotch pine; on the whole cover fairly complete; only in the western third along Grünwinkel through windfalls and dry wood cuttings somewhat thin and patchy; in the thin parts as yet little, up to 15 years old, advance growth in single trees. Growth good to fairly good. (Ilex found).</p> <p><i>b</i> — 27 acres (consisting of the upper south-eastern portion and a ridge running from it in a north-western direction to the centre of the compartment), 100—180 years old (some older), short-stemmed spruce with some Scotch pine and silver fir forming a thin, often very thin, wood; in parts younger up to 60 years old spruce, or an incomplete miserable under-</p>

DESCRIPTION OF COMPARTMENTS—*Continued.*

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
			<p>growth of 25 years old spruce and Scotch pine (experimental planting). Growth middling to inferior.</p> <p>c — 18 acres (uppermost part on the south) Grinde; heather land with 100 years and more old crippled Scotch pine, some spruce, birch thinly stocked; here and there remnants of 25 years old planted spruce and Scotch pine.</p>
Hoher Ochsen.....	7	101	<p>70 and up to over 100 years old Scotch pine and mountain pine with spruce, some birch, sometimes forming a very thin wood of single trees, sometimes in smaller or larger groups; everywhere intersected by heather places and blanks. Growth inferior, even crippled.</p>
Kleingartenkopf.....	8	76	<p>100—120 years old, in some parts younger, some over 800 years old, spruce with Scotch pine, few silver fir, some mountain pine. In the western third and on the eastern point still fairly well stocked, some groups even well stocked; otherwise the wood is very thin and open. Growth middling to inferior; here and there an incomplete miserable undergrowth of 80—60 and more years old spruce and Scotch pine (planted).</p>
Kleingarten.....	9	862	<p>a — 161 acres; spruce and silver fir, some beech. Mostly 60—80 years old, in strips and single trees up to 100 years old, others only 80—60 years old. In the eastern part are about 50 acres 80—100 years old. Everywhere spruce and silver fir standards up to 150 years old, mostly showing good growth. Almost throughout rather thinly stocked, here and there patchy, in consequence of late final cuttings and removal of cancerous silver firs. Growth mostly good, only toward the southern higher part decreasing.</p> <p>b — 122 acres (in 8 places); spruce and silver fir with some beech, $\frac{15-40}{\text{average} = 80}$ years old, some groups up to 60 years; mostly fully stocked, 120—160 years old (some older) mostly pruned spruce and silver firs in the final stage are standing almost everywhere over the above younger growth. The strip along Dobelbach is finally cleared. Growth good; of the old trees fairly good.</p> <p>c — 79 acres (upper part toward the south), 120—800 years old pruned Scotch pine and spruce, few silver fir and birch, thinly stocked, often open; on the whole poorly undergrown with 20—60 years old spruce (mostly planted), a few silver fir; the latter in some places form, with up to 100 years old spruce, the picture of a selection forest. Soil much covered with heather. Growth middling to bad; rarely fairly good.</p> <p>On 6 acres near compartment Dobelbach on the main path, 100 and more years old spruce, with a few Scotch pine and silver fir, form a thin canopy and show middling growth.</p>
Grossgarten.....	10	175	<p>a — 108 acres; spruce and silver fir 80—110 years old, some up to 150, some beech and a few Scotch pine. Partly fully stocked, but the greater part somewhat thin, in the lower part very thin; and here spruce and silver fir advance growth up to 60 years old in single trees and groups. Growth good to fairly good; in</p>

DESCRIPTION OF COMPARTMENTS—*Continued.*

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
Sachsenbronn.....	11	95 (and 2 acres other areas.)	<p>the upper parts with stones (Halde), partly middling only.</p> <p><i>b</i> = 87 acres. (Ridge through middle of compartment and strip on south, southwest, and northwest.) 90–110, some up to 200 years old, spruce and Scotch pine, some silver fir, in the uppermost part some mountain pine in a thin, patchy, and often very thin wood; most of inferior growth; here and there traces of 80–40 years old spruce plantings.</p> <p><i>c</i> = 80 acres (adjoining compartment Kleingarten). A wood resembling a selection forest, of spruce and silver fir with beech, the trees 80–60 years old prevailing; little quite young. The 100–120 years old and older trees appear single and in groups. Growth good; above the cattle track inferior.</p> <p>100–120 years old (some up to 200 years), spruce and silver fir, also some beech, namely:</p> <p>On 42 acres, final stage, partly pruned, throughout with $\frac{10-80}{20}$ years old (in the western part up to 40 years old), silver fir and spruce young growth; about 25 acres in the position of the seeding stage brought about by windfalls and dry wood cuttings; on 5 acres 80–100 years old, generally complete cover; in the thinner stocked parts is found up to 15 years old silver fir and spruce young growth; on 12 acres (southeastern corner, near compartment Gartenbach) generally canopy complete, here and there with a little advance growth.</p> <p>On 10 acres (in the west), 70–80 years old, some older spruce with silver fir, fairly complete canopy.</p> <p>On 7 acres (western point), 12–40 years old (in groups and single up to 60 years old), mostly irregular young growth of spruce with some silver fir, forming a fairly complete stocking.</p> <p>Growth of old trees good to fairly good, in the pruned portions partly less good; growth of young wood fairly good.</p>
Gartenbach	12	179	<p>110–140 years old spruce, silver fir, some older, some Scotch pine, the latter prevailing in places in the upper part, few beech; in the northern two-thirds in the final stage, partly in seeding stage. In these two-thirds about 85 acres are stocked with young growth of spruce and silver fir pretty completely, in the eastern part very fully; in the southern third still fairly complete cover, but on the western slope, already somewhat thin, as yet little young growth. Growth in northern two-thirds good, in the southern third good to fairly good; in the upper part, in the southeast, only middling.</p> <p>In the middle of the compartment are 3 windfalls and 1 beetle clearing, together 12 acres; of these, 7 acres fairly well stocked with up to 25 years old spruce and silver fir.</p>

TABULAR STATISTICAL REPORT

COMPARTMENTS.		DISTRIBUTION OF AGE					
		1—40 years old.		41—60.		61—80.	
Name.	No.	Cubic feet.	Acres	Cubic feet.	Acres	Cubic feet.	Acres
I. Working-section—Yield-capacity over							
Schwarzenbronn.....	1	48,080	41	70,680	20	.....	.....
Schwarzenberg.....	2	200,845	117	169,514	40	192,117	40
Riesenkopf.....	8	19,072	84	.....	.....	.....	.....
Grünwinkel.....	5	21,189	88	.....	.....	.....	.....
Dobelbach.....	6	.....	.....	.....	.....	.....	.....
Kleingarten.....	9	109,479	87	201,299	87	438,787	97
Grossgarten.....	10	26,437	24	46,617	11	25,074	5
Sachsenbronn.....	11	28,806	51	.....	.....	85,816	5
Gartenbach.....	12	18,420	48	.....	.....	.....	.....
Total.....		497,227	440	488,080	108	676,294	117
Normal state under a rotation of 120 years.....		.....	.....	.....	.....	.....	.....
Comparison of real and } + normal state.....		.....	.....	.....	.....	.....	.....
II. Working-section—Yield-capacity from							
Dobelbach.....	6	1,770	.....	.....	.....	.....	.....
Kleingartenkopf.....	8	10,595	25	.....	.....	.....	.....
Kleingarten.....	9	10,948	25	.....	.....	.....	.....
Grossgarten.....	10	.....	.....	.....	.....	.....	.....
Total.....		23,313	50	.....	.....	.....	.....
Normal state under a rotation of 120 years.....		.....	.....	.....	.....	.....	.....
Comparison of real and } + normal state.....		.....	.....	.....	.....	.....	.....
III. Working-section—Yield-capacity 7							
Riesenkopf.....	8	.....	.....	.....	.....	.....	.....
Mehlskopf.....	4	.....	.....	.....	.....	18,900	84
Grünwinkel.....	5	.....	.....	.....	.....	.....	.....
Dobelbach.....	6	.....	.....	.....	.....	.....	.....
Hoher Ochsenkopf.....	7	.....	.....	.....	.....	.....	.....
Total.....		.....	.....	.....	.....	18,900	84
Normal state under a rotation of 120 years.....		.....	.....	.....	.....	.....	.....
Comparison of real and } + normal state.....		.....	.....	.....	.....	.....	.....
Summary of the							
Real state of forest.....		.....	.....	.....	.....	.....	.....
Normal state of forest.....		.....	.....	.....	.....	.....	.....
Comparison of real and } + normal state.....		.....	.....	.....	.....	.....	.....

OF THE HERRENWIES RANGE.

CLASSES.						Volume per acre, cubic feet.	INCREMENT.			
81—100.		Over 100 years.		Total.			Annual, per acre.		Total in 10 years.	
Cubic ft.	Acres	Cubic ft.	Acres	Cubic ft.	Acres		Normal	Real.	Normal.	Real.
43 cubic feet per Acre Annually.										
15,892	3	84,350	4	152,910	65	2,852	85	70	55,250	45,500
		118,082	12	667,180	211	8,804	85	75	179,850	158,250
		881,408	87	400,480	71	5,641	70	61	49,700	48,810
		1,600,961	148	1,628,060	186	8,768	85	71	158,100	152,080
		1,532,104	188	1,522,104	188	11,444	100	71	188,000	94,430
353,156	49	640,329	48	1,628,060	288	5,768	100	78	298,000	220,740
494,418	49	968,870	49	968,468	188	6,945	85	85	117,800	117,800
42,379	5	459,108	84	565,408	95	5,952	100	71	95,000	67,450
		1,373,758	124	1,887,178	173	8,065	100	86	172,000	147,920
906,845	105	6,402,845	584	8,989,771	1,354	6,003	.....	76	.....	1,026,900
				7,456,200	.....	5,507	92	.....	1,242,700	.....
				1,488,571	.....	1,086	.....	16	.....	5,740
7 to 43 cubic feet per Acre Annually.										
		38,850	27	40,620	27	1,504	80	21	8,100	5,970
		208,418	51	214,018	76	2,816	14	14	10,640	10,640
		108,419	54	119,867	79	1,511	48	29	38,970	22,910
		79,460	87	79,460	87	2,148	21	21	7,770	7,770
		430,147	169	458,460	219	2,071	.....	21	.....	46,960
				862,880	.....	1,657	28	.....	60,480	.....
				90,580	.....	414	.....	7	.....	18,490
cubic feet and under per Acre Annually.										
		4,500	5	4,500	5	900	7	7	850	850
				18,900	84	556	7	7	2,880	2,880
		11,900	16	11,900	16	706	7	7	1,120	1,120
		7,400	18	7,400	18	411	7	7	1,260	1,260
		58,400	101	58,400	101	529	7	7	7,070	7,070
		76,600	140	95,500	174	549	.....	7	.....	12,180
				78,080	.....	420	7	.....	12,180	.....
				22,420	.....	129	.....	.....	.....	.....
Three Working Sections.										
				9,488,731	.....	.....	.....	.....	1,066,180	.....
				7,892,160	.....	.....	.....	.....	1,815,900	.....
				1,596,571	.....	.....	.....	.....	.....	229,280

SPECIAL WORKING PLAN.

COMPARTMENTS.	DESCRIPTION OF CUTTINGS, CULTIVATION, ETC.	CUTTINGS.		Cultivation. Acres.	Draining Ditches. Feet.	Road Construction. Feet.
		Final. Cubic feet.	Inter-mediate Cubic feet.			
1. Schwarzenbronn...	Final cutting in regenerated part.....	84,000	.....	.....	.....	.....
	Filling up blanks with spruce.....	.....	.....	8	.....	.....
	Thinning and cutting of cancerous silver firs.....	.....	10,000	.....	.....	.....
	Total.....	84,000	10,000	8	.....	.....
2. Schwarzenberg....	a Thinning of shelter-wood and partial final cutting.....	85,000	.....	.....	.....	.....
	Filling up blanks with spruce and Scotch pine.....	.....	.....	10	.....	.....
	a and b Thinning and removal of cancerous trees.....	.....	58,000	.....	.....	.....
	Total.....	85,000	58,000	10	.....	.....
3. Riesenkopf.....	a Seeding cutting, and partly final cutting.....	58,000	.....	.....	.....	.....
	b and c Rest.....	.....	.....	.....	.....	.....
4. Mehliakopf.....	Total.....	58,000	.....	.....	.....	.....
	Rest.....	.....	.....	.....	.....	.....
5. Grünwinkel.....	a Thinning of shelter-wood, seeding cutting in the fully stocked parts by the removal of cancerous and large trees.....	818,000	.....	.....	.....	.....
	b Rest.....	.....	.....	.....	.....	.....
	Total.....	818,000	.....	.....	.....	.....
6. Dobelbach.....	a Thinning and removal of cancerous trees.....	19,000	19,000	.....	.....	.....
	b and c Rest.....	.....	.....	.....	.....	.....
	Construction of an export road to meet the main road.....	.....	.....	.....	.....	4,900
	Total.....	19,000	19,000	.....	.....	4,900
7. Hober Ochsenkopf	Rest.....	.....	.....	.....	.....	.....
8. Kleingartenkopf..	Rest.....	.....	.....	.....	.....	.....

SPECIAL WORKING PLAN—*Continued.*

COMPARTMENTS.	DESCRIPTION OF CUTTINGS, CULTIVATION, ETC.	CUTTINGS.		Cultivation. Acres.	Draining Ditches. Feet.	Road Construction. Feet.
		Final. Cubic feet.	Inter-mediate Cubic feet.			
9. Kleingarten.....	a Cutting of all old standards and cancerous trees.....	45,000	8,000	.....	.....	.....
	Thinning.....	.....	.....	.....	.....	.....
	b Thinning of shelter-wood and partially final cutting.....	198,000	.....	.....	.....	.....
	Filling up blanks with spruce.....	.....	.....	12	.....	.....
	c Cutting out of old defective trees where young growth exists....	14,000	.....	.....	.....	.....
	Construction of an export road to meet the main road.....	.....	.....	.....	.....	9,500
	Total.....	257,000	8,000	12	.....	9,500
10. Grossegarten	a Thinning and removal of cancerous trees.....	47,000	47,000	.....	.....	.....
	b Rest.	.....	.....	.....	.....	.....
	c Removal of standards and cancerous trees....	25,000	.....	.....	.....	.....
	Thinning.....	.....	15,000	.....	.....	.....
	Construction of an export road.....	.....	.....	.....	.....	5,000
	Total.....	72,000	62,000	.....	.....	5,000
11. Sachsenbronn....	In the regeneration area: thinning of shelter-wood and partially final clearing; in the rest seeding cutting.....	168,000	.....	.....	.....	.....
	Filling up blanks with spruce.....	.....	.....	8	.....	.....
	Construction of an export road.....	.....	.....	.....	.....	8,500
	Total.....	168,000	.....	8	.....	8,500
12. Gartenbach.....	Continuation of regeneration cuttings and removal of cancerous trees.....	195,000	.....	.....	.....	.....
	Thinning in fully stocked parts.....	.....	7,000	.....	.....	.....
	Filling up blanks with spruce and Scotch pine.	.....	.....	8	.....	.....
	Construction of an export road.....	.....	.....	.....	.....	8,000
	Total.....	195,000	7,000	8	.....	8,000

SUMMARY OF THE PROVISIONS OF THE

COMPARTMENT.	PROVISIONS OF WORKING PLAN.					
	Cuttings.			Cultiva- tion. Acres.	Drain- ing. Feet.	Road Con- struction.
	Final. Cubic Feet.	Inter- mediate. Cubic Feet.	Total Cubic Feet.			
1. Schwarzenbrunn.....	84,000	10,000	44,000	8	.....	.....
2. Schwarzenberg	88,000	88,000	88,000	10	.....	.....
3. Riesenkopf.....	88,000	.....	88,000	.....	.....	.....
4. Mehlskopf.....	.....	.....	.....	.....	.....	.....
5. Grünwinkel	818,000	.....	818,000	.....	.....	.....
6. Dobelbach.....	19,000	19,000	88,000	.....	.....	4,900
7. Hoher Ochsenkopf...	.....	.....	.....	.....	.....	.....
8. Kleingartenkopf .....	.....	.....	.....	.....	.....	.....
9. Kleingarten	267,000	8,000	260,000	12	.....	9,500
10. Grossgarten	72,000	62,000	184,000	.....	.....	5,000
11. Sachsenbrunn	168,000	.....	168,000	8	.....	3,500
12. Gartenbach	195,000	7,000	202,000	8	.....	3,000
Total	1,146,000	154,000	1,800,000	86	.....	25,900

NOTE.—The excess was due to heavy windfalls; it will not derange future

WORKING PLAN AND OF THE EXECUTION.

RESULTS OF ACTUAL WORK DONE.						COMPARISON OF PROPOSED AND EXECUTED CUTTINGS.		Remarks.
Cuttings.			Culti- vation. Acres.	Drain- ing. Feet.	Road Con- struction. Feet.	Cut too much. Cubic Feet.	Cut too little. Cubic Feet.	
Final. Cubic Feet.	Inter- mediate. Cubic Feet.	Total. Cubic Feet.						
38,084	12,549	45,588	4.4	.....	.....	1,588	.....	Excess due to windfalls and snow-break.
54,517	75,000	129,517	5.0	.....	.....	41,517	.....
122,900	.....	122,900	.1	.....	.....	79,900	.....	Excess due to windfalls and snow-break.
.....	
177,169	.....	177,169	.1	.....	.....	.....	140,881	Held back, on account of ex- tra fellings in other compts.
86,806	68,801	154,907	.....	.....	5,008	116,907	.....
.....	.....	.....	.....	.....	.....	.....	.....	Excess due to windfalls.
842,444	21,635	864,079	8.4	.....	9,679	104,079	.....
95,852	.....	95,852	.....	.....	5,299	.....	38,148	Thinning held over.
111,049	.....	111,049	.9	.....	8,691	.....	51,951	
197,930	.....	197,930	.....	.....	2,958	.....	4,840	Held back on account of ex- cess in other compartments
1,231,231	177,485	1,408,716	18.9	.....	26,625	108,716	.....

arrangements, as there is yet a considerable excess of growing stock in the forest.

SAMPLE PAGE OF THE DETAILED CONTROL BOOK.

1. *Schwarzenbronn.*

Year.	Description of Cuttings, Cultivation, etc.	CUTTING.		Cultivation. Acres.	Draining Ditches. Feet.	Road Construction. Feet.
		Final Cubic feet.	Inter- mediate Cubic feet.			
<i>Provision of Working Plan.</i>						
	Final cutting in regenerated part..	84,000				
	Filling up blanks with spruce			8		
	Thinning and cutting of cancerous silver firs.....		10,000			
	Total.....	84,000	10,000	8		
<i>Execution.</i>						
1884	Final cutting	14,297				
1884	Dry and windfall wood.....	818				
1885	Windfalls	665				
1886	Final cutting, thinning.....	6,166	882			
1886	Windfalls	547				
1887	Windfalls	1,368				
1888	Final cutting, thinning.....	7,769	11,717			
1888	Planting.....			1.7		
1888	Windfalls	82				
1889	Dry wood, windfalls	649				
1889	Planting.....			2.2		
1890	Windfalls	698				
1890	Planting.....			.1		
1891	Planting.....			.2		
1892	Planting.....			.1		
1893	Planting.....			.1		
	Total.....	38,064	12,549	4.4		



Norway (red) pine reproduction in windfall, Big Fork River, 1902.
(By T. S. Woolsey, Jr.)

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FORESTRY

NINTH ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

OF

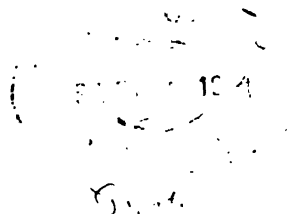
MINNESOTA

UNDER THE ACT OF THE LEGISLATURE ENTITLED
"AN ACT TO PROVIDE FOR THE PRESERVATION OF FORESTS OF THIS STATE AND FOR
THE PREVENTION AND SUPPRESSION OF FOREST AND PRAIRIE FIRES,"
APPROVED APRIL 18, 1895, AND AS AMENDED BY
THE ACT OF APRIL 21, 1903

FOR THE YEAR 1903.

ST. PAUL, MINN.:
PRINTED BY THE PIONEER PRESS COMPANY.
1904.

T. 5520



STATE OF MINNESOTA,
OFFICE OF CHIEF FIRE WARDEN,
ST. PAUL, MAY 17, 1904.. }

Hon. S. G. Iverson, State Auditor and Forest Commissioner:

SIR: As required by section 3 of the Act for the Preservation of Forests, etc., approved April 18, 1895, amended by the Act of April 21, 1903, I have the honor to submit, herewith, my annual report for the year 1903.

Very respectfully,

C. C. ANDREWS,

Chief Fire Warden.

NINTH ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

OF MINNESOTA.

The standing timber in Minnesota is worth easily \$100,000,000, and it is this property which the fire warden system seeks to protect. The state itself owns 2,500,000 acres of land, a part of which is forested and protected by the fire warden system. The state last November sold \$600,000 worth of timber from its own land, and has in all received \$4,000,000 for just the timber sold from exclusively its lands which it received as a gift from the United States. The state will continue for many years to sell timber of various kinds from these lands, and is on this particular account deeply interested in preventing damage by forest fires.

The local service in preventing and fighting fires, both forest and prairie, is rendered by the town supervisors, who are ex-officio fire wardens, and by those whom they summon to assist, and in unorganized territory by fire wardens specially appointed. This service is paid for in the first instance by the counties in which it is rendered, and the state pays to the counties two-thirds of such expense. Up to last year the state paid to the counties

only one-third of such expense. It is expected that the counties now will be more prompt and liberal in paying such service. In an ordinary year it may be assumed that the two-thirds of expense the state has to reimburse to the counties will amount to \$4,000. The other expenses pertain to the office of Chief Fire Warden, and include his salary, clerk hire, traveling expenses, postage, printing of warning notices, blanks, circulars, etc., and an edition of 4,000 copies of his annual report.

The item to cover all these expenses is found in the general appropriation act under the head of "Forest Preservation"; and I think the public will be surprised to learn that it amounts to only \$5,000. It is an amount—I will not say wholly—but very inadequate for the efficient execution of the law. I recommend that the appropriation for each of the next two fiscal years for "Forest Preservation" be \$10,000, and I trust that you will strongly indorse the recommendation. The amount which the legislature appropriates depends principally upon the Senate Committee on Finance and the House Committee on Appropriations. I have not failed to appear repeatedly before those committees to urge a larger appropriation.

Nobody knows when an exceptionally dangerous season may occur. It will not do to wait until it has come. Every spring the local fire wardens in about six hundred towns must be furnished with notices, instructions and blanks and kept on the alert so that in case a drouth should occur they will be active in preventing dangerous fires. The economical use of money is in the prevention of fires.

Our neighbor the province of Ontario expends \$30,000 and upwards a year in the prevention and extinguishment of forest fires.

FOREST FIRES ELSEWHERE.

Before referring to the situation in this state in respect to fires, I would call to mind the excessive drouth, attended with very destructive forest fires, which prevailed in Oregon and Washington in the autumn of 1902, and the similar condition in the eastern states and Lower Canada in the spring and early summer of 1903. We are liable any year to experience a similar drouth, and should be prepared for it.

FOREST FIRES IN MINNESOTA, 1903.

Although wet weather prevailed during the latter part of the summer and in the season of harvesting, there were dry spells in the spring and late autumn. The number of forest fires reported by fire wardens was 52, which burned over an area of 15,585 acres and did damage to the amount of \$28,292. At 27 of these fires, being a little more than half, a fire warden was present to assist in extinguishing and controlling the fire. Of these fires 11 were caused by clearing land, 9 by railroad locomotives, 7 from other known cause, and 25 originated from cause unknown.

The number of prairie fires reported was 35, which burned over 26,308 acres and did damage to the amount of \$4,666. At 14 of these fires a fire warden was present, and assisted in extinguishing and controlling the same. They were caused, 9 from burning brush, straw or stubble, 4 by railroad locomotives, 3 by hunters, 6 from other known cause and 13 from cause unknown.

PROSECUTIONS.

There were 8 prosecutions for causing forest and prairie fires, and 4 convictions obtained. There is naturally great reluctance on the part of fire wardens to prosecute

their neighbors or fellow citizens for carelessness in causing fires, but how shall we abate the habit of negligence in the use of fire in dry weather unless it is made known that an offender will be held to account? If we leave the law a dead letter, what is going to prevent some terrible catastrophe in an extremely dry period? Are not humanity and kindness really on the side of a rigorous rather than a lax enforcement of the law? No man has a right to be setting fire either to brush or meadows in very dry weather. Any person of good conscience and common sense who sets fire to clear land or for other purpose will take such precautions by piling his brush, digging and carefully burning fire breaks as will prevent fire getting beyond his control.

The law as it now stands reads as follows: "Any fire warden who knows or has information of facts and circumstances which he believes can be established, and which if so proven would show beyond a reasonable doubt that any person has caused a fire in violation of this act, shall immediately go before a justice of the peace and make complaint thereof." The law requires that fire wardens shall, "without delay, inquire into the cause of each forest and prairie fire within their districts, and shall immediately report the same to the Chief Fire Warden." These officers have no discretion in the matter. The law is imperative, and they must, if they do their duty as respectable citizens and officers, prosecute people who carelessly cause forest or prairie fires, if evidence can be obtained.

It sometimes happens that witnesses will not swear in a trial of the case to just what they have previously stated. Convictions may not always be certain, but it does good in a community in such cases to have it understood that an honest and impartial effort will be made to have the law rigidly enforced. In this way we may prevent another Hinckley fire.



A view of Cass Lake from high ground. Much of the beautiful scenery in this locality has been mutilated by "dead and-down" logging.
Photographed, September, 1900, for the annual report of the Chief Fire Warden of Minnesota.

RAILROAD RIGHT OF WAYS.

Section 12 of the fire warden law requires railroad companies (which of course includes logging railroad companies) to keep their right of way to the width of 50 feet on each side of the center of the main track cleared of combustible materials. This is found to be a rather difficult provision to enforce. While some roads are kept cleared of combustible material in an exemplary manner, there are companies which are habitually neglectful in this regard. Railroad companies keep posted at their stations along their lines warning notices, furnished by the state, against forest and prairie fires, and which set forth, among other things, that any railroad company failing to keep its right of way cleared of combustible materials is liable to a fine not exceeding \$100. What must the public riding over these roads think to read these notices, and then to see by the rubbish and combustible material left along the right of way that the company fails to live up to the law? On the other hand, where a company keeps its right of way thoroughly cleared of combustible material and in a trim condition, how valuable the example is, aside from the security against fires. It should not cost very much to do this work, and neglect of the railroad company faithfully to have it done does not indicate that scrupulous care which the public has a right to expect of corporations which are, above all others, supposed to exercise the strictest care that is possible.

With a view of having railroad companies observe more strictly this provision of law requiring their right of ways to be kept cleared of combustible materials a blank, like the one printed below, was furnished to the fire wardens whose towns are traversed by railroads. Pursuant to this 12 reports were received showing that the right of way was not clear of combustible material, and 24 reports

were received showing that the right of way was clear of combustible material; but the instructions do not require any report except in case the right of way is not cleared of combustible material. In cases where evidence of neglect was reported the facts were laid before the proper county attorneys, with request that prosecutions be instituted.

The enforcement of this provision of the law depends very much upon the assistance which is furnished by county attorneys.

STATE OF MINNESOTA.

Fire Warden's Report of Combustible Materials on Railroad Right of Way.

Section 12 of the Fire Warden Law (chapter 196, General Laws of Minn., 1895, as amended by the act approved April 21, 1903) requires every railroad company to keep its right of way to the width of fifty feet on each side of the main track cleared of all combustible materials. This requirement is set forth in the notices freshly posted each year at every railway station, and its disregard is likely to be noticed by the public to the discredit of the fire warden service, let alone the pecuniary damage that might result. Fire wardens are hereby instructed to promptly report any violation of this provision. They will be held strictly responsible for its enforcement. Especially will the chairman inspect in a dry season, and before dangerous weather, any railroad right of way in his town where there is adjoining property over which fire would be likely to spread and do damage if started on the right of way, and if combustible material, whether dry grass, weeds, bushes or other kind, is found on the right of way, to immediately report the facts to the Chief Fire Warden in the form below. In such case there should be an additional respectable witness of the combustible materials. The fire warden who discovers the presence of combustible materials in a case as above stated will promptly warn the section foreman or other proper railroad employe or officer to remove the same, and will observe and report to the Chief Fire Warden whether, and when, such material is removed. Respectfully,

C. C. ANDREWS,
Chief Fire Warden.

ST. PAUL, May 7, 1903.

To the Chief Fire Warden, St. Paul, Minn.:

On the day of 190.... the undersigned personally inspected the right-of-way of the (state name of railroad company) railroad, in the town of being Township No.... Range.... in the County of for the distance of (state about the number of miles or rods inspected) about and between and (indicate locality as nearly as practicable). Combustible materials consisting of (state whether dry grass, weeds, bushes or what kind, and how high and abundant, and whether standing, cut or in heaps)

were found (state whether on one, and which, or both sides of the right-of-way and what breadth of the right-of-way from center of the track).....

Such combustible material extended along the right-of-way a distance of about (state number of rods or miles).....

and between (indicate by village, stream, farm or other object) and.....

Adjoining the right-of-way where such combustible material was found there was on (state which side) the.....side (state whether timber, bushes, stubble, grain in shock or stack, hay in shock or stack, or what property and whose, if you know, that could be damaged or endangered by the spread of fire, and about to what extent. If there was property on both sides of the right-of-way that could be endangered by fire spreading from combustible material on the right-of-way, so state and describe the same. Be particular and follow these instructions carefully).....

.....

The weather was.....

Name and address of the witness who accompanied the undersigned is.....

P. O. Signature.....

Date..... Named of Organized Township.....

SUMMARY OF FOREST FIRES, 1903.

COUNTY AND TOWN.	Date.	Acres.	Damage.	Cause.
Aitkin County— Millward.....	June 5.....	40	\$75	Unknown.
Anoka County— Bethel.....	May 8.....	320	12	Burning hay.
Beltrami County— Black Duck.....	May 7.....	3	None	Clearing land.
Black Duck.....	May 17.....	3	None	Children playing.
Black Duck.....	July 22.....	20	500	Railroad locomotive.
Black Duck.....	July 27.....	120	1,800	Unknown.
Frohn.....	May 19.....	500	200	Clearing land.
Grant Valley.....	April 17.....	70	300	Railroad locomotive.
Grant Valley.....	April 22.....	100	500	Railroad locomotive.
Grant Valley.....	May 7.....	30	250	Railroad locomotive.
Hagalie.....	July 15.....	20	100	Unknown.
Hornet.....	June 4.....	25	10	Clearing land.
Lammers.....	July 29.....	640	200	Railroad locomotive.

SUMMARY OF FOREST FIRES, 1903—*Continued.*

COUNTY AND TOWN.	Date.	Acres.	Damage.	Cause.
Carlton County—				
Knife Falls.....	June 4.....	160	None	Clearing land.
Knife Falls.....	June 28.....	40	None	Unknown.
Cass County—				
Twp. 146, R. 31....	July 28.....	320	150	Unknown.
Twp. 145, R. 30....	Nov. 4.....	10	50	Railroad locomotive.
Clearwater County—				
Leon.....	June 22.....	160	35	Unknown.
Moose Creek.....	May 16.....	160	30	Unknown.
Moose Creek.....	May 23.....	80	10	Burning meadow.
Shevlin.....	.....	120	None	Burning brush.
Cook County—				
Hovland.....	June 7.....	640	1,000	Unknown.
Maple Hill.....	June 1.....	200	None	Clearing land.
Maple Hill.....	August 23.....	5	10	Land cruisers.
Maple Hill.....	August 30....	1	5	Land cruisers.
Tofte (58-5).....	June 7.....	160	1,800	Burning rubbish.
Tofte (60-3).....	June 7.....	2,000	10,000	Clearing land.
Itasca County—				
Campbell.....	June 3.....	600	800	Clearing land.
Moose Park.....	June 7.....	1½	None	Unknown.
Nashwauk.....	April 27.....	300	2,000	Unknown.
Nashwauk.....	June 1.....	350	1,000	Unknown.
Nashwauk.....	June 7.....	280	2,000	Unknown.
Third River.....	May 15.....	160	50	Clearing land.
Kittson County.....				
Arveson.....	May 7.....	1,500	300	Unknown.
Deerwood.....	April 17.....	160	50	Unknown.
Lake County—				
Two Harbors.....	May 31.....	100	None	Railroad locomotive.
Morrison County—				
Buckman.....	Nov. 20.....	2,000	400	Unknown.
Clough.....	Nov. 18.....	600	80	Clearing land.
Roseau County—				
Herim.....	Oct. 19.....	1,500	200	Unknown.
St. Louis County—				
Canosia.....	June 29.....	30	25	Railroad locomotive.
Duluth.....	June 7.....	20	Slight	Unknown.
Herman.....	June 28.....	2	20	Railroad locomotive.
Lakewood.....	June 7.....	40	50	Unknown.
Midway.....	April 27.....	60	20	Campers.
Missabe Mountain..	June 7.....	160	1,000	Unknown.
Missabe Mountain..	June 21.....	160	500	Unknown.
Sparta.....	June 7.....	200	2,000	Unknown.
Twp. 54, R. 21....	June 7.....	1,200	600	Unknown.
Twp. 55, R. 18....	June 26.....	100	60	Unknown.
Twp. 61, R. 14....	June 30.....	7	50	Unknown.
Todd County—				
Browerville.....	May 2.....	1,000	Brush	Unknown.
Burnhamville.....	April 27.....	100	50	Clearing land.

Total acres burned over, 15,585. Damage, \$28,292.

Classification of causes:

Clearing land, 11.

Railroad locomotives, 9.

Other causes, 7.

Unknown, 25.

REPORT OF FIRE WARDENS AND OTHERS OF FOREST
FIRES FOR 1903.

AITKIN COUNTY.

Ernest Rainins, chairman, town of Millward, June 24:

On the 3d instant, about 3 o'clock, p. m., a fire started on section 5, which burned over 40 acres and destroyed nearly 15 acres of fine, green, old birch and balsam; damage \$75. I was working on section 6 and saw heavy, black smoke beginning to rise from section 5; I immediately went to the fire, which was burning briskly on land cut over last winter. It was extinguished by watching and holding it. Eight persons assisted. I notified the chairman of the town of Beaver to be ready if more men should be needed. The weather was dry and windy, and had been dry for about two weeks. I believe someone walking over the land started the fire with no reason for so doing.

ANOKA COUNTY.

W. S. Fenderson, chairman, town of Bethel, May 8.

A fire today, caused by someone burning hay land on section 13, burned over half a section of meadow and light timber; damage \$12. It came near burning a house, barn and outbuildings; was extinguished in 6 hours by two men digging a trench. Weather dry and windy for five days. The fire did not burn deep enough to kill the timber.

BELTRAMI COUNTY.

D. D. Rolfe, president, village of Black Duck, September 23:

May 7th a fire on section 12, caused by clearing land and burning brush, burned over about 3 acres of light timber; damage nominal. It was extinguished by using the street engine and hose. Weather dry and windy; had been dry all spring.

Same, September 23:

A fire May 17th burned over about 3 acres of partly cleared land on section 12; damage nominal. Origin unknown, probably by children playing. Fire was extinguished in 6 hours, thirty-one persons assisting, by using the street engine, hose and buckets. Weather dry and windy; had been dry all spring.

Same, September 23:

On the 22nd and 23rd of July a fire started at 1 o'clock on section 18 and burned over about 20 acres of heavy cedar timber; damage \$500. The fire is supposed to have been started by the train. It was extinguished in 28 hours by twenty-two persons, using the street engine, hose and buckets and chopping down trees. Weather dry.

Same, September 23:

On the 27th of July a fire on section 13 burned over about 120 acres of heavy cedar timber and destroyed poles and posts; damage \$1,800. It was caused, as near as we can find out, from a chimney in one of the cedar camps or from a freight train. Weather dry with high wind. It was extinguished in 7 hours by two hundred persons assisting, and by using the hose and mains, street engine and bucket brigade.

J. W. Speelman, chairman, town of Turtle Lake, September 8:

The summer was very dry until August 1st.

Nelson Willett, chairman, town of Frohn, May 12:

On the 9th instant at 10 o'clock a fire originating on section 28 burned over 500 acres of heavy timber and destroyed some camps and small timber; damage \$200; caused by clearing land. It was extinguished in 12 hours by the use of shovels on road ways. Weather dry and windy; had been dry for a week.

A. P. Reeve, fire warden, town of Hagalie, July 16:

Yesterday noon a fire on section 35 burned over about 20 acres of cedar slashings and destroyed a small amount of cedar poles and posts; damage \$100. The fire was extinguished in 3 hours by the help of twenty-five or thirty persons by back-firing and carrying water. Weather very dry, light windy gusts. The fire would have been very serious if not checked at the start. I saw the smoke and was there when it had about a quarter of an acre burned over, and being on horseback I made quick time in getting men out. The fire started near the corner of section 36 and endangered \$3,000 worth of timber. Gust Dohrman, chairman, town of Grant Valley, May 9:

Fires April 17th and 27th caused by sparks from a Great Northern locomotive did damage estimated at from \$75 to \$100. The weather was very dry. The fires were extinguished by the use of shovels and water carried in buckets.

Henry Plumer, chairman, town of Hornet, May 8:

June 4th a fire caused by clearing land on section 25 burned over 10 acres of light cedar and destroyed a very few logs and killed a few trees; damage \$25. It was extinguished in 24 hours by the help of five persons, putting water on the dry road ahead of the fire. Weather

dry for two weeks. There is much slashing in our town this spring. Should present dry weather continue there will soon be danger of fire here.

Same, June 26:

On the 14th we had a small fire which was soon put out. It was started at the pulp camps.

Andrew Larson, chairman, town of Lammers, August 3:

July 29th, in the afternoon, a fire on sections 18 and 19 burned over 600 acres of brush and destroyed about 20 tons of hay—clover and timothy; damage \$200. There was also a fire on sections 7 and 8; came from the adjoining township on the west, but did no damage. It has been impossible to extinguish it; but now we have some rain, so I think it is dead now. Weather has been dry the whole summer. I might say this country has never been so dry. I have been out three days around those fires and we thought we had them all out, but when we got a warm day they started up again. The first mentioned fire was supposed to have been started by a railroad locomotive.

CARLTON COUNTY.

John Blomberg, chairman, town of Knife Falls, October 30:

On the 4th of June a fire on section 1 burned over 160 acres of brush and light timber. It was thought that the fire was started by the wind from a clearing belonging to a settler living in the same section, who was clearing land and burning brush at the time. It was extinguished in 12 hours by the help of eight persons carrying water, digging ditches and covering fire with the dirt; also felling trees. Weather dry and windy; had been dry about 4 weeks.

Same, October 30:

June 28th a fire on section 1, town 49, range 17, burned over 40 acres of brush and light timber. Was extinguished by carrying water, digging and felling trees and brush. Weather dry and windy; had been dry about 7 weeks. There was no loss sustained, as the land owners as a rule would like to have such lands burned over if it can be done safely; but they have to turn out and fight the fire in order to hinder the possibility of burning their homes.

Henry Baldwin, chairman, town of Twin Lakes, June 26:

If the present dry weather continues I fear we will have some fires to fight.

E. N. Rogers, president, village of Scanlon, July 7:

Your circular letter of recent date received and contents carefully noted. In reply will say that you may depend upon me to help you all that I can to suppress fire in and around our village. We have had two fires within the last thirty days and have had to call out from fifty to one hundred men at each time; in fact, to-day we had a fire and found it necessary to take out all of our dry lumber crew, amounting to seventy-five men, for one hour.

CASS COUNTY.

C. H. Beaulieu, Bena, September 12:

On the 5th instant in the afternoon a fire on section 26, town 145, range 28, set by sparks from a railroad locomotive, burned over half an acre of peat bog; no damage. It was extinguished in 3 hours by three men using brush brooms and water. Windy weather; had been dry over 10 days.

George Stein, president village of Cass Lake, July 28:
(Telegram)

Forest fire raging four days north end of large island in Cass lake; also one up Turtle River, both raging badly owing to extremely dry weather. No settlers in this territory, what shall I do to preserve forest?

Same, July 29: (Telegram)

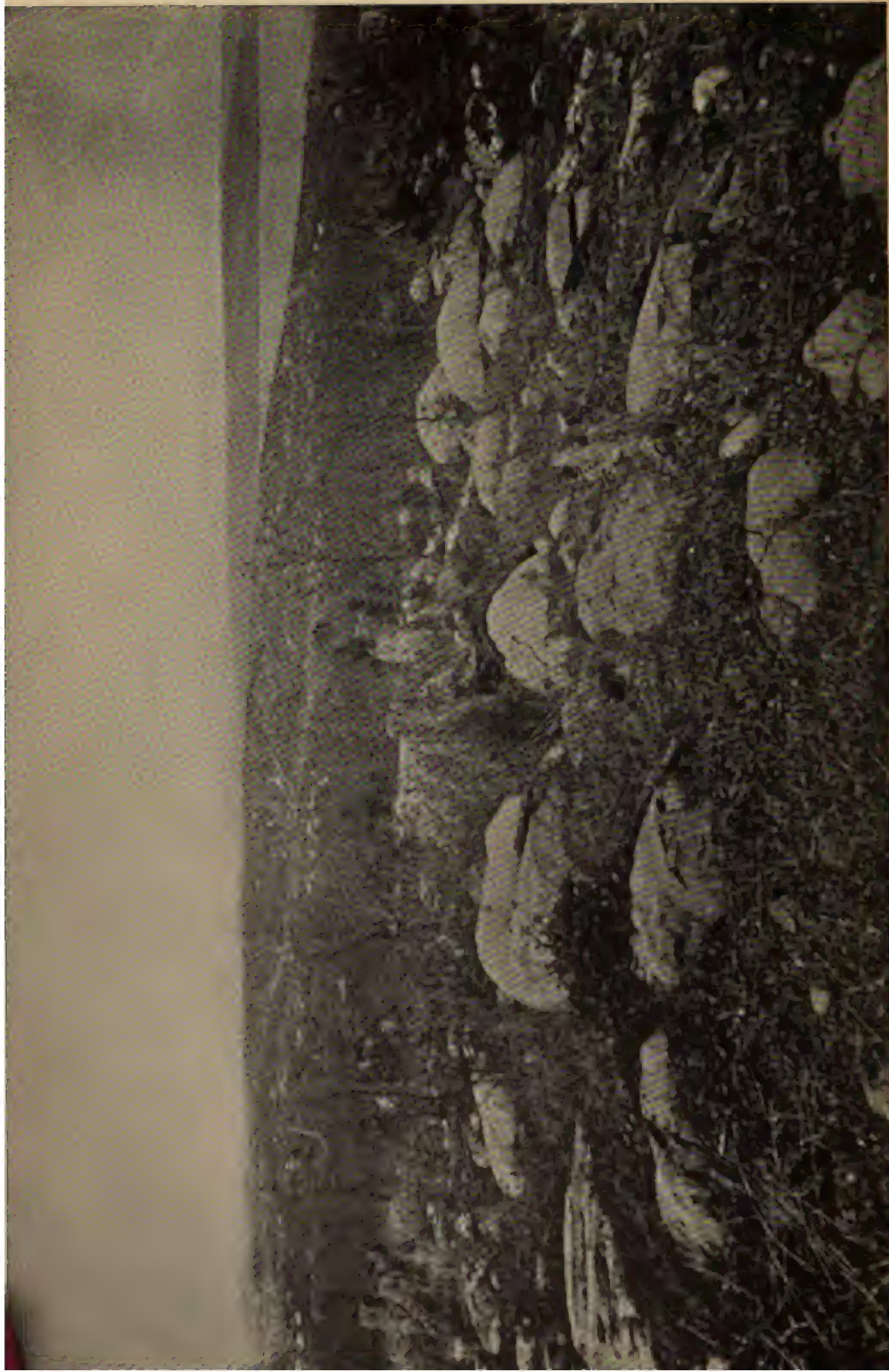
Had force of men out to-day, killed fire on Star Island. Will look after Turtle River fire to-morrow.

Same, July 31:

In the matter of fire on Star Island. After subduing the fire last Wednesday I left three men on the ground as a patrol. They have had more or less of fire fighting to do ever since. The dry leaf mould that has accumulated for years is the cause, as the fire seems to be under this mould, and finally breaks out and then being whipped by a breeze starts the fire. The men left there go over the ground constantly and when fire is discovered it is promptly handled. This method of warfare will no doubt have to continue until we get a good heavy shower. In the meantime I will keep them there and furnish them with plenty to eat.

Same, August 12:

The fire burned over a territory about one mile long and half mile wide. A swamp on the west and Lake Helen on the north prevented it from spreading further in that direction, which gave us the south and east ends to fight. Where the fire raged the fiercest luckily happened to be in the smaller brush and the jack pine, the high winds prevalent from the south keeping it away from the Norways and white pine to a great extent. When we arrived on the scene the fire was just getting a good start among a nice lot of Norways. Before same was extinguished we lost about three trees and a dozen or more



Cut-over, non-agricultural pine land, now useless, near Ely. If planted with pine would earn a good revenue. There are probably a million acres of rocky, non-agricultural land in the State that have been cut over, and are now useless. The State has a large amount of such land, and it is a waste to let it remain in this condition. It should be planted with pine, and the revenue from the annual harvest of the timber should be used for the benefit of the State.

were badly scorched and burnt. Had the wind been from the north I am afraid it would have been quite a difficult matter to have saved much of the Norways. I made diligent inquiries among the whites who had been camping on the island up to that time, but none of them appeared to acknowledge camping in the vicinity where the fire started, nor do I believe they did, because the location would not be desirable. Indians were picking a great many berries in that locality and I feel quite certain it resulted through some carelessness on their part.

Same, November 4: (Telegram)

Bad forest fire raging in white pine near Cuba, five miles east. Will leave with force of men about 10:30 per train furnished gratis. If necessary will increase force in morning. Weather conditions favorable.

Same, November 5: (Telegram)

Fire subdued. Will leave couple of patrols in charge.

Same, November 6:

The fire was near what is called Cuba siding; burnt on south side of track over an area of about 10 acres. Considerable slashings and dry stubs in the vicinity, where some years ago dead and down logging was done to some extent. Fire destroyed the seedlings, but neither Mr. Bruce (of the Forestry Bureau) nor myself could find where it destroyed the hardy white pine. Weather conditions were fine; had there been a wind it would have taken quite a force and much time to check it. Fire may have originated from railroad engine sparks; also from travelers or tramps, who just now continually build camp fires en route. Two such "hobo" fires were burning between here and the scene of the forest fire on the night we went there.

CLEARWATER COUNTY.

Alfred Forander, chairman, town of Moose Creek, May 23:

About noon the 16th instant a fire on section 34 burned over 160 acres of heavy and light timber; destroyed 5 or 6 cords of wood.

Same, June 5;

May 23d a fire on section 35 burned over 80 acres and destroyed about 500 poplars of pole size. There is a big slough one mile across and four miles long and the fire came in on us from that slough. It was extinguished in three hours by back-firing. The wind was high.

F. A. Norquist, chairman, town of Pine Lake, August 10:

It is very dry here this summer.

Same, August 24:

The weather has been quite dry until to-day, it is raining hard.

O. J. Larson, chairman, town of Shevlin, July 30:

A fire on section 13 (township 147, range 36), July 15, burned over 120 acres of brush land; no damage. It was caused by burning brush piles. As the weather was very dry and windy part of the time it could not be put out, but was kept under control until it rained. Weather dry for about a month and windy part of the time.

COOK COUNTY.

Ole E. Erickson, chairman, town of Hovland, June 29:

June 7th a fire, cause unknown, burned over 640 acres of principally green timber on sections 11 and 12; damage \$1,000. It was extinguished June 16th by the help of six persons, five being part of a lumber crew. It was kept back in the daytime as best we could, but at night and early morning we could do the most active work. There was a good deal of dry, fallen cedar. There had been about two weeks or more of dry weather before the fire

and it was dry and windy at the time, but we got a rain storm on the night of the 16th.

August Johnson, chairman, town of Maple Hill, June 15:

June 1st a fire on section 2 burned over 100 acres of brush land, but destroyed nothing of real value. It was extinguished thirteen days after it started, by the help of forty-seven persons, with water and shoveling dirt on the fire.

Same, August 27:

On Sunday, the 23d we discovered fire in section 11-62-1 E., near Elbow Lake, and I sent at once an assistant to extinguish the same. Five acres of green timber was undermined by fire so that the trees fell to the ground, but to-day the fire is out, and I have two watchmen to watch it for further spread. Weather very dry and windy. Also report from 64-1 E., section 2, where there is also fire. It is very difficult to get there on account of road and waterways. It is about thirty miles from here, but I will do my best to attend to it. This fire has been set by cruisers, and the guilty party I may be able to locate, and I will report to you.

Same, September 9:

August 30th a fire caused by land cruisers on section 11, town 64, range 1 E., burned over an acre of light timber and destroyed a few trees. It was extinguished in three days after it started. Weather very dry and windy.

H. O. Engelson, fire warden, town of Tofte, June 13:

June 7th a fire on section 6, town 58, range 5, burned over 160 acres of light timber and buildings; damage \$1,800. It was caused by the burning of a small pile of rubbish in front of men's sleeping camp of a lumber company. Weather extremely dry and windy, had been dry for more than a week. Fire was extinguished by carrying water from Lake Superior and by the rain which came in the evening.

C. A. A. Nelson, fire warden, town of Tofte, June 17:

On the 7th instant a fire on section 27, town 60, range 3, caused by burning brush, spread over 2,000 acres of light timber land and destroyed a logging camp with implements and two homestead houses; did damage to the amount of \$6,000, including \$4,000 worth of buildings. It was extinguished in nine days, eleven persons assisting, by digging up dirt, cutting down timber and carrying water. The weather was dry and windy, had been dry for two or three weeks.

ITASCA COUNTY.

James Troy, chairman, town of Bridgie, October 30:

There has been no fire in this town, but in the town adjoining on the west (151-30) ties were made last winter in section 36, through which the railroad runs, and the slashing is all over the whole section, which would cause great damage to the state timber if it caught fire. It should be looked into, as fire could easily start and run east into the settlement of Bridgie, and great damage be done.

H. C. Grove, chairman, town of Campbell, June 11:

On the 4th instant a fire caused by burning brush on section 25, town 155, range 25, burned over about 600 acres of brush, jack pine and some Norway, mostly small timber and some down timber; damage \$800. Weather dry and had been dry for some time, with hardly any wind. It was extinguished in four days after it started, with the help of about twenty persons, using axes and shovels and cutting down timber and digging trenches; some places a team and plow were used. The fire was fought more or less all the time until it was put out by rain. This is the only organized town for miles around. Parts of the country are sandy and covered with jack pine and in dry weather very dangerous in case of fire. There

is no wagon road in here; the mail is packed here from Mizpah to Ripple (P. O.) It is in town 154, range 25. Big Falls is in section 2, town 154, range 25; Ripple, the post office, is in the same section. The road from here to Black Duck is swampy and can only be traveled afoot.

Henry Cole, chairman, town of Moose Park, June 9:

On the 7th instant, about noon, a fire on section 17 burned over half an acre of brush and slashings; no damage done. It was extinguished with the help of seven persons by carrying water in pails, there being a creek close by. It was almost impossible to put the fire out, as it hung to the roots and moss. Weather dry and windy, has been dry all spring, with no rain to amount to anything.

S. R. Elliott, Sup't Crosby Mine, Nashwauk, April 29:

April 27th a fire came from the south of our property, which is situated in sections 31 and 32, town 57, range 22, and destroyed much cord wood belonging to us.

Same, May 13:

The fire of April 27th burned only about 75 cords of wood which we had cut. It would have burned all of our buildings if we had not fought it with our whole force of about 100 men. Two dwelling houses were destroyed and much cord wood belonging to other parties.

C. E. Walton, chairman, town of Nashwauk, May 11:

I have inquired into this fire you have mentioned, but it is almost impossible to find out anything about it, for there are so many tramps and lawless gangs around here camping through the woods. This fire started south of us, near the railroad track, but cannot find out any more about it.

Same, June 1:

A fire on this date burned over part of sections 31 and 32; destroyed an ice house; also from 300 to 400 cords

of wood. It is still burning; damage \$1,000. It is impossible to find out how it was caused. Thirty-three persons assisted in controlling the fire with buckets and hose from the mines. Had to let it run as far as the mine before we could stop it. Weather dry and windy; dry about two weeks.

Same, June 9:

On Sunday, the 7th instant, a fire burned over 140 acres in section 31, 140 acres in section 32 and 340 acres in section 29, of both heavy and light timber, and destroyed two of our houses at the lower mine; damage to mining property \$2,000. Number persons assisting in controlling the fire was from 200 to 300. It was finally extinguished by rain. Weather dry and very windy.

F. S. Arnold, chairman, town of Third River, July 11:

On or about May 15th a forest fire ran through the southwest quarter of the southeast quarter of section 24. So far as I can ascertain no great damage was done, but I am unable to state how the fire originated.

KITTSOON COUNTY.

Frank Peterson, chairman, town of Arveson, May 11:

On the 7th instant a fire burned over 1,500 acres of brush and prairie and some poplar groves. Twelve persons assisted in putting the fire out with help of team and breaking plow; also by using wet sacks. Weather dry, with west wind.

B. M. Bathum, chairman, town of Deerwood, April 22:

April 17th at 9 A. M., a fire on section 3 burned over 160 acres of light timber and brush. Have investigated but am unable to find out who set the fire. Neighbors claim it was set by a party driving on the road. It was put out in five hours by the help of eight persons.

LAKE COUNTY.

L. St. Jaques, chairman, town of Two Harbors, June 22:

May 31st a fire on section 15, town 53, range 11, burned over 100 acres of cut-over timber and was caused by sparks from an engine. No damage. It was extinguished in one day with the help of six persons by back-firing. Weather dry.

MORRISON COUNTY.

Samuel Tedford, chairman, town of Clough, December 1:

On the 18th of November a fire, caused by burning brush on section 5, burned over 600 acres; destroyed 10 tons of hay. Damage \$80. It was extinguished by the help of eight persons by water and other means. Weather windy and dry.

J. O. Baker, chairman, town of Morrill, November 23:

On the 20th instant a fire on section 36 burned over an area of five miles in length by 4 rods to $1\frac{1}{2}$ miles in width of meadow and light timber; destroyed about 50 tons of hay. Damage \$400. I cannot find the party who set the fire; nobody seemed to know anything about it. The fire was extinguished in twelve hours by individuals—about fifteen fighting it for the protection of their own property. Weather dry for seven or eight weeks, very high wind.

ROSEAU COUNTY.

Thomas Larson, chairman, town of Deer, November 4:

On the 19th of October in the afternoon, a fire burned over 1,500 acres of brush, meadow and light timber; destroyed about 75 tons of hay. Damage \$200. It burned to a big slough, when it stopped. It came from the town of Herim. The weather had been dry about a week and the wind blew hard from the northwest, which

brought the fire into our town, where all the hay was destroyed. We have spent three days trying to find out who set the fire, but are unable to find out.

ST. LOUIS COUNTY.

Edward Olson, president, village of McKinley, in township of Biwabik, June 27:

We are in no danger at present from forest fires. The fire the first part of this month caught in slashings from the Elba Iron Company and burned over about 80 acres of ground, but no valuable timber was destroyed.

Olof Shirley, fire warden, town of Canosia, June 29:

If this dry weather keeps on we shall have some bad forest fires on account of the M. & W. R. R. locomotives. They are setting fire every day at certain places where the sparks fall in combustible material. I do not think they have the right kind of spark arresters on.

Henry Kirke, chairman, town of Duluth, June 15:

On the 7th instant a fire on section 34, about seven miles from where I live, burned over from 15 to 20 acres old choppings; destroyed some cedar ties—there was no valuable timber; very high wind all day. Weather had been dry ten or twelve days. The fire was finally put out by rain.

C. G. Almquist, chairman, town of Herman, June 2:

There have been some small fires along the line of the logging railroad from Scanlon, doing small damage; but if dry weather starts in there might be danger of some big fires caused from it.

Same, July 1:

June 28th at 4 P. M., a fire on section 20, probably caused by the logging train, burned over two acres of light timber; destroyed five cords of wood and some pine. Extinguished by shoveling earth over it. Weather dry but no wind.

David Jamieson, chairman, town of Lakewood, October 27:

June 7th a fire on section 18 burned over 40 acres of light timber; destroyed a small quantity of hardwood. Damage possibly \$50. Was extinguished in 12 hours after it started by heavy rain. The weather had been dry for about two weeks before the fire and was windy the day of the fire.

H. B. Hill, chairman, town of Midway, October 23:

April 27th a fire on section 29 burned over 60 acres of brush land; was probably set by hunters or campers. It was extinguished in five hours with the help of fifteen persons by water.

A. J. Sullivan, chairman, town of Mesaba Mountain,
June 12:

On Sunday, the 7th instant, a fire on section 35, on the south shore of Lost Lake, burned over 160 acres of brush and old slashings; damage \$1,000. A strong wind was blowing from the northwest and the fire burned fiercely through the old slashings, including some timber and cordwood, until it reached the green timber on the south, where it died. The fire lasted about six hours. A number of men and the owner went to fight the fire but could make no noticeable impression. The weather was not dry. It rained heavily about six days previous. Wind very high.

Same, June 27, Telegram:

Fire north of Genoa confined to slashings. Very little loss to pine. I have had men looking after it all week. Impossible to stamp it out, as weather is very dry, with high winds prevailing. Will write report.

Same, June 30:

On the 21st instant about 1 p. m., a fire originating on section 27—cause unknown—perhaps from wad of a hunter's gun—burned over 160 acres of slashings; de-

stroyed very little standing timber. Damage perhaps \$500. Weather very dry, with high wind prevailing. Four men watched the fire and it was finally extinguished in a week by heavy rains.

D. E. Mouser, Sparta, June 26, Telegram:

Forest fire burning fiercely north of Genoa. Place you inspected. Spread to the large pine.

Same, June 27, Telegram:

Fire mostly out; unless wind rises will be all right.

John Hillman, Floodwood, June 15:

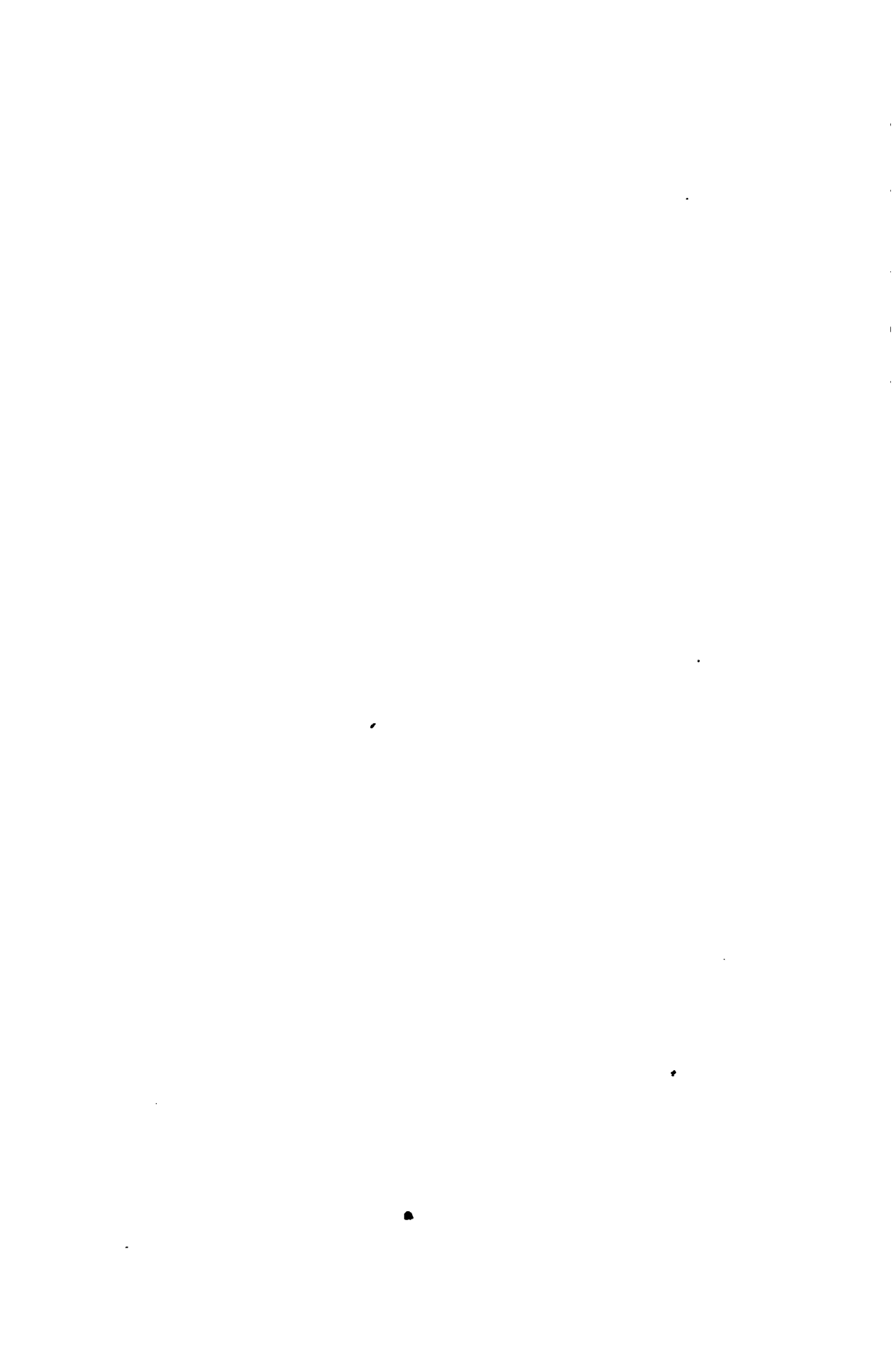
On the 7th instant a fire originating on section 7, town 54, range 21, burned over 1,200 acres of cut-over land; destroyed 200,000 feet of pine. Damage \$600. Four persons assisted in controlling the fire. Rain started and extinguished it.

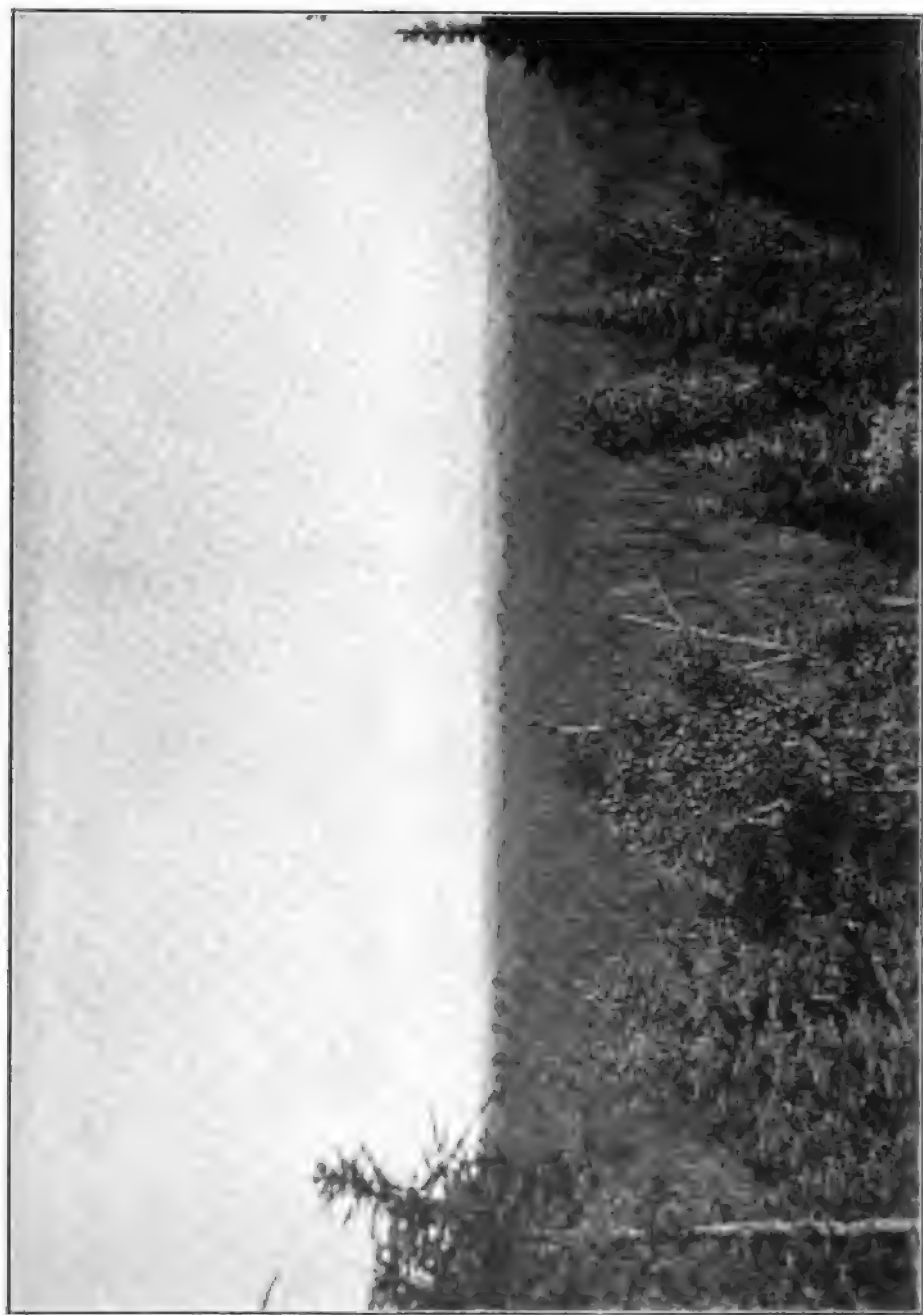
Chas. Lauren, fire warden, Zim, June 29:

June 26th a fire in the northwest part of town 55, range 18, burned over 100 acres of brush, slashings and light timber; destroyed 6,000 feet of pine and a few cedars. Damage \$60. Weather dry and windy; had been dry for about three weeks. The fire was running along both sides of the logging railroad where timber had been cut last winter. It was controlled by making fire breaks and was finally extinguished by rain.

Chas. Heise, Tower, October 10:

The last Sunday in June we had a fire in section 4, town 61, range 14, and when I saw the smoke I got help from one of the camps and we worked about four hours and had it all out. There were about seven acres burned over. We had no large fires during the season, which was prevented by my putting out small fires.





Southeastern part of Lake Superior Forest Reserve, looking north from high bank of river leading from Wigwam Lake. Photographed July 15, 1923, for the annual report of the Chief Fire Warden of Minnesota.

TODD COUNTY.

Hans Hammer, chairman, town of Little Elk, May 19:

May 2nd a fire in the southwest part of the town burned over 1,000 acres of brush but did no damage. The weather had been dry for some time and windy. A heavy rain extinguished the fire, since which time there has been plenty rain.

Frank Krutzer, chairman, town of Burnhamville, May 18:

On the 27th of April a fire on section 28, caused by clearing land, burned over 100 acres of light timber; damage \$50. It was extinguished by plowing and with water. Weather dry and windy.

SUMMARY OF PRAIRIE FIRES, 1903.

COUNTY AND TOWN.	Date.	Acres.	Damage.	Cause.
Anoka County—				
Linwood.....	May 13.....	15	Slight	Burning meadow
Clay County—				
Barnesville.....	April 26.....	1,200	\$25	Unknown.
Elkton	Oct. 31.....	500	210	Burning stubble.
Hawley.....	Oct. 31.....	50	200	Unknown.
Riverton.....	April 27.....	3,000	50	Unknown.
Riverton.....	Oct. 31.....	1,500	1,500	Burning stubble.
Ulen.....	Oct. 21.....	60	50	Burning stubble.
Kittson County—				
Clow	Oct. 19.....	2,000	500	Boys.
Deerwood.....	April 17.....	1,600	.....	Unknown.
Hazelton	Sept. 30.....	300	91	Hunters.
Hazelton	Nov. 1.....	60	None	Unknown.
Jupiter	Nov. 14.....	320	None	Unknown.
Norway	May 15.....	500	100	Burning brush.
Pelan	Oct. 31.....	500	75	Burning stubble.
Percy.....	Oct. 25.....	1,200	None	Unknown.
Richardville	April 21.....	40	None	Unknown.
St. Joseph.....	Oct. 10.....	800	200	Burning break.
Teien	July 28.....	120	125	Smoker.
Marshall County—				
Agder.....	Oct. —.....	1,000	None	Hunters.
Augsburg	Nov. 10.....	620	50	Burning fire break.
Foldal	Oct. 10.....	200	25	Burning straw.
Grandplain.....	Oct. 22.....	500	None	Hunters.
Morrison County—				
Ripley.....	April 15.....	40	None	Small boy.

SUMMARY OF PRAIRIE FIRES, 1903—*Continued.*

COUNTY AND TOWN.	Date.	Acres.	Damage.	Cause.
Otter Tail County— Carlisle.....	Nov. 3.....	3	None	Railroad locomotive.
Polk County— Argus.....	Oct. 15.....	1,000	70	Railroad locomotive.
Onstad.....	Sept. 24.....	800	500	Railroad locomotive.
Red Lake County— North.....	May 20.....	400	None	Clearing land.
Terrebonne.....	July 15.....	160	240	Unknown.
Roseau County— Dewey.....	Oct. 28.....	400	100	Clearing land.
Polonia.....	Mch. 9.....	40	50	Clearing land.
Polonia.....	Oct. 10.....	1,200	200	Unknown.
Polonia.....	Oct. 29.....	400	80	Unknown.
Wilkin County— Manston.....	April 4.....	6,000	200	Unknown.
Mitchell.....	April 4.....	200	None	Unknown.
Prairie View.....	Sept. 24.....	80	25	Railroad locomotive.

Total acres burned over, 26,308. Damage, \$4,666.

Classification of causes:

Burning brush, straw or stubble, 9.

Railroad locomotives, 4.

Hunters, 3.

Other causes, 7.

Unknown, 13.

REPORT OF FIRE WARDENS AND OTHERS OF PRAIRIE FIRES FOR 1903.

ANOKA COUNTY.

J. R. Broadbent, chairman, town of Linwood, May 14:

Yesterday a fire on section 32 burned over 15 acres of meadow and would have destroyed a bridge had it not been extinguished. As it was, no damage was done.

CLAY COUNTY.

R. Sieber, chairman, town of Barnesville, May 4:

April 26th a fire in the south part of the town burned over 1,200 acres and destroyed hay of the value of \$25. It went across the creek to section 23. I could not find out how it was set. There was a strong wind.

Leander Swartz, chairman, town of Elkton, November 3:

On the 31st of October a fire caused by burning stubble, the weather being dry, burned over several hundred acres in the north part of the town and destroyed about 70 tons of hay; damage \$210. Many persons helped extinguish the fire by plowing and whipping with wet sacks. The party who caused the fire was tried and fined \$45 and costs.

W. Fountain, chairman, town of Hawley, November 2:

October 31st about 4 o'clock P. M., a fire burned over 40 or 50 acres of wild meadow and destroyed 40 tons of hay; damage \$200. It was extinguished in about four hours by plowing and back-firing. A whole threshing crew and others volunteered. The weather was dry and had been dry about two weeks; but little wind. The fire originated, it is supposed, near Downer, Minnesota, six or eight miles southwest of where it touched our town. It just touched one corner of the township.

Same, November 16:

I find that the fire which I reported the 2d instant was caused by a party who set fire to burn off the land when he had made a fire break of only six furrows. He was fined \$45 and cost.

Edward Weaver, chairman, town of Riverton, April 27:

On the 26th instant a fire which originated on section 36 burned over seven sections and destroyed two stacks of hay of the value of \$50. It was extinguished in twelve

hours with plows, sacks and brooms. Weather had been dry for a week.

Same, November 2:

October 31st a fire burned over 1,500 acres of prairie and destroyed twenty-eight hay stacks; damage \$1,500. It was controlled by twenty-five persons, using six plows and wet sacks and by back-firing. Weather dry with high wind. (Same fire reported by L. Swartz.)

E. Rost, chairman, town of Ulen, October 25:

On the 21st instant a fire caused by a boy 15 years old, plowing and who started a fire to burn off the dead grass and weeds, burned over 60 acres and destroyed two hay stacks of the value of \$40 to \$50. Sixteen persons assisted in extinguishing the fire.

KITTSOON COUNTY.

Richard Sylvester, chairman, town of Clow, October 21:

On the 19th instant a fire supposed to have been set by two boys 12 and 14 years old, burned over 2,000 acres of prairie and meadow and destroyed 150 tons of hay; damage \$500. The fire ran as far as the prairie went. Weather dry and windy for about four weeks.

John Stramquist, chairman, town of Deerwood, April 25:

On the 7th instant a fire originating on section 24 burned over 1,600 acres of brush and prairie. Weather dry and windy. It was extinguished by ten persons putting it out along roads and fields.

Isaac Ristad, Fire Warden, town of Hazelton, October 19:

On the 30th of September a fire burned over two-thirds of section 27 and destroyed about eight tons of hay and thirty acres of green timber; damage \$91. All that I can learn is that there were three chicken hunters who set the fire, but I cannot find any way to identify them. Thirty-five persons assisted in putting out the fire. It was

extinguished in nine hours after it started, with sacks, brush and two teams and plows. It was dry and very windy all that day, but it had been damp weather about a week before.

Ole Krogstad, chairman, town of Hazelton, November 10:

On the 1st instant at 3 P. M., a fire burned over 60 acres of prairie on section 16. After thorough investigation the cause cannot be discovered. Three persons assisted in putting it out, using brooms made of willows.

Louis Swanson, chairman, town of Jupiter, November 17:

On the 14th instant a fire burned over 320 acres on section 23. Seventeen persons assisted in putting it out. The weather was dry and calm.

N. G. Bengtson, town clerk, town of Jupiter, December 9:

As to the fire reported by Mr. Swanson of November 14th, it was very hard to say what damage it might have done if it had not been extinguished; one thing is sure, had the wind started up and blew hard lots of hay stacks would have been burned and probably some houses. As it was, very little damage was done. It burned only some old grass. The land belongs to speculators and there is no cultivation done on that section.

Isak T. Tolland, chairman, town of Norway, May 18:

May 15th, a fire caused by burning brush and roots on section 2, town of Deerwood, burned over 500 acres of brush and swamp on section 35 of this town; damage \$100. It was extinguished with the help of nine men. Weather dry and windy for about five days.

C. E. Kelso, chairman, town of Pelan, December 10:

On the 31st of October a fire originating on section 22 burned over 500 acres of prairie and brush and destroyed one homestead shanty and about twelve tons of hay; damage \$75. The fire could not be controlled in this

town and went into another town. Weather dry and windy, had been dry for about three weeks.

Same, January 2, 1904:

The party accused of setting the fire of October 31st has been tried and acquitted.

B. Nelson, chairman, town of Percy, October 30:

On the 25th of October a fire which came from the north, town 162, range 46, into this town on section 5, where the land is unsettled, spread over sections 8, 9 and 10. It was extinguished in the evening by the work of nine persons by back-firing and using wet sacks, thus saving 140 tons of hay. If the fire had not been checked in time it would have done damage to hay and buildings. There was wind from the northwest and it has been dry for four weeks. The fire burned over about 1,200 acres of meadow and brush land. There has been fire in North town over two weeks.

Geo. Richards, chairman, town of Richardville, May 1:

April 21st a fire burned over a few sections of prairie in the northwest part of the town; no damage done here. The weather was quite windy. I cannot find out who started the fire nor exactly where it started from. I was not at home, being away to a funeral that afternoon.

John Zalewski, chairman, town of St. Joseph, October 10:

At 9 o'clock today a fire originating on section 8 burned over 800 acres of meadow and brush and destroyed 50 tons of hay and some poplars; damage \$200. South wind and dry for one week. The fire went to Manitoba. It is believed to have been caused by a person burning a fire break around a haystack.

Louis E. Johnson, chairman, town of Teien, August 15:

July 28 a fire on section 36, caused by a farmer from Dakota cutting hay, burned over 120 acres of prairie and meadow and destroyed 30 tons of hay in stack and 40

tons standing; damage \$125. It was extinguished in three hours with the help of fifteen or twenty persons by plowing and by using wet sacks. Weather windy and dry; had been dry for a long time.

MARSHALL COUNTY.

Bernhard Knudsen, chairman, town of Agder, November 2:

In October a prairie fire burned over about 1,000 acres of swamp but destroyed nothing of value. The weather was dry and windy the whole of last month.

Chas. Warner, chairman, town of Augsburg, November 14:

On the 10th of August a fire caused by two boys trying to burn around their haystack in section 1 burned over 620 acres and destroyed three stacks of hay; damage \$50. It was extinguished in eight hours by ten persons with plows and wet sacks. Weather quite windy.

Amund Johnson, chairman, town of Foldal, October 15:

On the 10th instant about 10 o'clock a. m., a fire supposed to have started from an old burning strawstack spread over 200 acres of brush and prairie and destroyed one haystack; damage \$25. The weather was dry, with strong wind.

Henry Roller, chairman, town of Grand Plain, October 21:

October 18th a fire set by hunters burned over 500 acres of prairie and swamp in township 156, range 42. It was extinguished in two days by twelve persons by plowing, back firing and beating with wet sacks. A dwelling house was saved and 150 tons of hay. Weather very dry and windy and had been dry most of the time.

MORRISON COUNTY.

J. A. Adams, chairman, town of Ripley, May 2:

April 15th a field fire burned over 40 acres and died out. Supposed to have been set by a small boy; no damage. There had been a heavy rain three days before the fire occurred. The fire by which an old lady lost her life was half a mile distant from this fire and was set by herself. It destroyed no property and was not a prairie fire.

OTTER TAIL COUNTY.

William Zimmer, chairman, town of Carlisle, November 4:

On the 3rd instant a fire caused by sparks from a railroad locomotive burned over 3 acres but did no damage. It was extinguished by one person with wet sacks and shovel. Weather dry and windy for about 2 weeks.

POLK COUNTY.

S. M. Clover, chairman, town of Angus, October 26:

On the 15th instant a fire, thought to have caught from sparks from a locomotive on the G. N. R. R., burned over 1,000 acres; destroyed about 70 tons of hay and 1 barn worth \$70. It was extinguished in 10 hours by eight persons by plowing in front of it with a 4-horse gang plow and a 3-horse breaking plow, confining it within certain limits. Weather dry and very windy:

Sever Quarberg, chairman, town of Onstad, September 29:

September 24th about 10 o'clock a. m., a fire caused by an N. P. locomotive burned over 800 acres and destroyed about 125 tons of wild hay of the value of \$500. It was extinguished in 4 hours by twelve persons and six teams plowing furrows and dousing with wet sacks. Weather dry and windy; had been dry for about 8 days.

RED LAKE COUNTY.

Mrs. E. Avetson, St. Hilaire, May 1:

A prairie fire has been set and has burnt all the hay I had.

John S. Smith, chairman, town of North, October 28:

May 20th a fire supposed to have been set by a farmer clearing hay land burned over 400 acres but did no damage. The weather was dry and windy; had been dry for about three weeks before.

Louis Parenteau, chairman, town of Terre Bonne,
November 12:

July 15th a fire burned over 160 acres of hay land and destroyed about 35 tons of hay already cut; damage \$240. Cause unknown. Four persons assisted in putting the fire out. Having no water, had to plow around it and use brush brooms. Weather dry and had been dry for a couple of months.

ROSEAU COUNTY.

Julius Johnson, chairman, town of Dewey, November 2:

On the 28th of October a fire caused by clearing land burned over about 400 acres of prairie and destroyed 18 tons of hay; damage \$100. It went out after reaching a wet slough. The weather was dry and windy, had been dry for about three weeks.

Henry Brufladt, Siggstad, October 16:

A prairie fire was started about eight miles south of here across the Roseau swamp on the 10th of October, the wind being the hardest we had this summer, and struck my grove and jumped the fire break and came near destroying all my property. I saved all except my hay—50 loads of number one hay destroyed—leaving me with hardly any for the winter for ten head of cattle and

five horses. It is noticed that a fire is started in the same neighborhood nearly every fall.

Joseph Kansy, chairman, town of Polonia, November 6:

On the 29th of October a fire on section 36 burned over 400 acres and destroyed 20 tons of hay; damage \$80. It was extinguished in four hours by eight persons with water and wet sacks. Weather for about a month has been dry and windy.

Same, November 15:

The fire of October 10th which damaged Henry Bruf-ladt, living on section 4, township 162, range 44, started as nearly as I can trace it on the northwest quarter of section 33, township 161, range 44. A prairie fire was started at 11 a. m., and it burned over 1200 acres of swamp and meadow. The weather was dry and windy and had been dry for about two weeks. It did damage to the amount of \$200 to Henry Bruf-ladt by burning 50 tons of his hay.

John Dietz, Fire Warden, town of Polonia, May 9:

May 7th a fire set to clear land before breaking burned over 40 acres and did damage to the amount of \$50. It was extinguished by three persons with sacks and blankets. It came within 100 feet of buildings. The weather was very dry and windy and it was very hard to stop the fire, but we did it.

TRAVERSE COUNTY.

John Keaveny, chairman, town of Tintah, August 24:

Two days ago threshing was done close to the right of way of the public road and straw lies two feet in depth on public highway. A cigar stump thrown from the hand of a careless smoker would start a fire which with a south wind would perhaps burn all the town that lies west of the railroad track in the village. It looks very risky.



A splendid stand of primeval white pine on rocky non-agricultural land near Hibbing. Illustrates a leading principle of forestry, namely, that land left for agriculture can yield a handsome and sustained revenue if devoted to forest. In the present ways of lumbering, such land after being cleared is lost forever. Photographed, 1907, for the annual report of the Chief Forester of Minnesota, and reprinted from his fourth report.

[He was instructed that there is a provision in the statutes against encumbering a highway, and that, if he would report the facts to the county attorney with request to act, he would undoubtedly adopt proper proceedings to remove danger; also that he was required by section 6 of the fire warden law to take "precautions to prevent fires," and when the weather was favorable he could cause the straw to be burned.]

WADENA COUNTY.

N. R. Carper, chairman, town of Wing River, May 1:

At this time of the year there are numerous fires. People generally burn their meadows, and sometimes the fire gets away and occasionally burns a stack of hay. Now these fires are in every direction. There is no timber here of any value except for fire wood. Only the other day there were many fires, and one man lost his hay. I did not learn of it for a couple of days. Please inform me as to the best course to pursue.

[He was instructed to use his best discretion and go to any fire if he thought the occupant of the land was a person liable to be careless.]

WILKIN COUNTY.

Herman Buth, chairman, town of Manston, June 24:

On the 4th of April, a fire in the west half of the town, which came across section 36 in the town of Mitchell, burned over 10 sections and destroyed hay, grain and bridges; damage \$200. It was extinguished by ten persons plowing and breaking and beating with sacks and water.

G. J. Czicholzki, chairman, town of Mitchell, June 30:

A fire April 4th burned over a narrow strip of section 14 but destroyed nothing. It was so close to the town line it was hard to tell in what town it started.

Walter Peake, chairman, town of Prairie View, November 24:

September 24th a fire on section 33 caused by sparks from a railroad engine burned over 80 acres of prairie and destroyed about 10 tons of hay; damage \$25. This was the only fire we have had this year. Dry weather at that time.

LAWS OF DIFFERENT STATES FOR THE PREVENTION OF FOREST FIRES.

MAINE.

The law of the State of Maine of March 25, 1891, constituted the Land Commissioner as Forest Commissioner, with \$200 increase of salary, which amount was doubled in 1903.

The selectmen are made fire wardens in their towns, the town to be divided into three districts according to roads, streams or lot lines, of which the town clerk shall make a permanent record, and a fire warden is assigned to each district. Their services are to be paid at the same rate as other official service, but no town is to pay for extinguishing forest fires in any one year an amount greater than two per cent upon its valuation for taxation. Those who assist in extinguishing fires are paid by the town, but not exceeding fifteen cents per hour.

For unorganized places the county commissioners may appoint not exceeding ten fire wardens in any one county, with same power as in towns, to be paid the same rate as in towns, the county to pay one-half of the expense, and the owner of the land on which the fire occurred the other half.

Any person who builds a camp or cooking fire on or adjoining any woods and fails to extinguish it is liable to a fine not exceeding \$100 or imprisonment one month.

The Forest Commissioner, with the advice of the Superintendent of Public Instruction, shall take measures for awakening an interest in behalf of forestry in the public schools, academies and colleges, and of imparting some degree of elementary instruction upon this subject therein.

Important new legislation was enacted by Maine in 1903. The law of March 26, of that year, made it the duty of the Forest Commissioner to appoint forest wardens "in all plantations and unorganized townships," who are to patrol the forests, prevent and extinguish forest fires and to hold office during his pleasure. They are to receive \$2 a day for each day of actual service, and may summon to their assistance citizens, to be paid fifteen cents for each hour of service. All expense incurred to be paid from the funds appropriated for the Forest Commission. The legislature of 1903 appropriated, as an "emergency fund for the prevention and extinguishment of forest fires," \$10,000 for the year 1903, and the same amount for the year 1904. It also appropriated for "public instruction in forestry" \$2,500 for the year 1903 and an equal amount for the same purpose for the year 1904. These amounts are in addition to the appropriation for the expense of the Forest Commissioner's office.

CONNECTICUT.

The law of Connecticut of June 17, 1901 (chapter 175), required the Board of Control of the Agricultural Experiment Station at New Haven to appoint "a man qualified by scientific training and practical experience to be State Forester," with authority to buy land in the state "suitable for the growth of oak, pine and chesnut lumber, at a price not exceeding \$4 per acre," and to plant the land with seeds or seedlings of such trees, or such other trees as he may deem expedient, at a cost not

exceeding \$2.50 per acre. He was required to protect such lands from forest fires, from trespassers, etc. The sum of \$1,000 annually was appropriated for carrying out the provisions of the law. The law was amended by the act of June 3, 1903, by striking out the limitation of expense for planting the land with seed or seedlings and by adding a provision to allow him to employ such local assistance as he deems necessary for the protection of the land from fire or trespass.

NEW YORK.

The State of New York in 1885 made town supervisors fire wardens, and that system was in use until 1896, when the Forest, Fish and Game Commission was authorized to appoint a fire warden for each town in the sixteen counties containing land belonging to the forest preserve. In the other towns the supervisors still act as fire wardens. The pay of fire wardens is \$2.50 per day during the time they are on duty, and those who assist in the prevention and suppression of fires are paid \$2 a day. The expense of fire warden service is paid by the town in which the service is rendered; and the state pays the towns one-half of such expense. The office of Superintendent of State Forests was created at the beginning of New York's forestry system. His salary is \$3,000 a year. In 1900 the office of Chief Fire Warden was created, with a salary of \$1,500 a year. He has supervision of the town fire wardens. The state also employs three forestry experts. The appropriation for the salaries and expenses of these five officers in 1903 was \$12,800; and for one-half of the town expenses in suppressing fires \$5,000. These items of course do not include printing expenses nor for any experimental field work.

NEW JERSEY.

The law of New Jersey of April 3, 1902, authorizes any city, township or other municipality to raise money for preventing, fighting and extinguishing forest fires; and where money has been so appropriated to appoint a suitable person as fire marshal, who may appoint deputies and aids to assist in the prevention and extinguishment of such fires, and who shall be paid reasonable compensation. He shall report concerning forest fires to the governing body which appointed him. It is made the duty of the justices of the peace to investigate the origin of fires, and they are clothed with authority for such purpose; and if they find sufficient evidence they may have the offender held to await the action of the next grand jury. The fire marshal has the power of a constable, and he may serve the necessary papers in course of an investigation. The state appropriates twice the amount raised by any municipality for the prevention and extinguishment of forest fires, provided that the amount paid by the state to any one municipality in any one year for such purpose shall not exceed \$200; and provided that the total amount paid by the state in any one year shall not exceed the sum of \$10,000.

PENNSYLVANIA.

In Pennsylvania the constables are made fire wardens. The towns there first pay the expense and the state pays one-half. There is a Forestry Commissioner and a Forestry Reservation Commission, of which the Forestry Commissioner is president, that is authorized to purchase any suitable land for forest preservation at not exceeding \$5 per acre.

The appropriations made by the legislature of Pennsylvania for the department of forestry for the two fiscal years beginning June 1, 1903 (and not including expenses

for preventing and extinguishing forest fires), amounted to \$23,216. In addition, the expense of printing and binding eight thousand copies of the report of the department of forestry for each of said fiscal years is to be paid out of the printing fund. Also the law of May 13, 1903, appropriated \$16,000 to erect buildings on the Mont Alto State Forestry Reservation and to provide practical instruction in forestry therein; the instruction not to cost exceeding \$10,000 for the two fiscal years ending June 1, 1905.

The Act of April 15, 1903, limits the amount of money which the State Forestry Reservation Commission shall expend for the purchase of land for forestry reserves to \$300,000 a year.

MICHIGAN.

The legislature of the state of Michigan has enacted a law which was approved June 18, 1903, and which, with a few exceptions, is a copy of the Minnesota fire warden law as it was previous to the amendments adopted by the last legislature. The exceptions are these: The law applies only within the territory lying north of the north line of township 20 north. It makes the Land Commissioner Forest Commissioner, and authorizes him to appoint a deputy to be known as the Chief Fire Warden, and who receives a salary of only \$500 a year; persons who are employed to assist in extinguishing fires are paid \$2 a day; services of fire wardens and helpers to be paid by the town—state to pay one-third. Where a town embraces more than one surveyed township, the supervisors may appoint a fire warden for such additional township.

WISCONSIN.

The last legislature of Wisconsin enacted an important forestry law, which was approved May 22, 1903. It

establishes a department of State Forestry with a board of five commissioners, consisting of the Attorney General, Secretary of State, State Treasurer, and two to be appointed by the Governor, who are authorized to appoint a Superintendent of State Forests, with a salary of \$2,500 a year, and who is ex-officio Forest Warden. It is his duty to enforce the law for the prevention and extinguishment of forest and marsh fires and to appoint one or more fire wardens in each town in twenty-nine of the northern counties which are named. They can summon any resident of the town or immediate vicinity to assist in preventing or extinguishing fires. Fire wardens and those who assist in extinguishing fires are paid not exceeding twenty-five cents per hour, which shall be paid out of the treasury of the town in which the service is rendered, but not exceeding \$100 for each town of thirty-six sections shall be paid in any one year. Fire wardens are to be paid not exceeding twenty-five cents per hour for posting notices furnished by the superintendent.

"All public lands remaining unsold and all lands so withdrawn from sale and such other lands as the state may hereafter acquire for that purpose shall constitute the State Forest Reserve."

The Superintendent of state forests is to establish one or more experiment stations on lands that belong to the state forest reserve, for the purpose of conducting researches into the best methods of forest management under the conditions prevailing in the various portions of Wisconsin.

He is to remove and sell all dead and down timber on the reserve.

The sale of all lands belonging to the state except lands that are in fact swamp lands and lands suitable for agriculture, wood lots convenient to farm homes and isolated tracts, not exceeding 80 acres each, shall cease after this act shall have gone into effect.

The sum of \$3,000 is appropriated to carry out the provisions of the act, in addition to the salary therein provided.

COLORADO.

The law of Colorado of April 11, 1903, makes sheriffs, under-sheriffs and deputies fire wardens of their respective counties in case of prairie or forest fires, and empowers them to call to their aid in extinguishing such fires such persons in their county as they may deem necessary. The sheriff is paid \$5 a day for such services and his deputies \$3 a day; the county commissioners to allow the same; and such other expenses as they deem just.

The Forest, Fish and Game Commissioner of Colorado receives a salary of \$1,800 a year, and \$4,500 a year is appropriated for the salaries of "Forest and Game Wardens."

WASHINGTON.

The devastating forest fires which prevailed in the State of Washington in the fall of 1902, led that state to enact the law of March 16, 1903, "to protect forests from fire." It constitutes the State Land Commissioner as ex-officio State Forest Fire Warden. County Commissioners may appoint deputy fire wardens, prescribe the territory to be patrolled by them and fix their compensation. State land cruisers are made ex-officio forest patrolmen. The State Forest Fire Warden is to enforce the law and investigate the origin of forest fires. County Commissioners in timber counties may fix a close season during which any person shall not burn any slashings or choppings without first obtaining permission in writing from the county board. Fire wardens must patrol their districts, post warning notices, warn campers or other users of fire and impress help to stop fires. The State Forest Fire Warden must enforce all laws for the protec-

tion of forests within the state and investigate the origin of all forest fires. "Any person who shall on any land within the state set or leave any fire that shall spread and damage or destroy property of any kind, not his own, shall be punished by a fine of not less than \$10 nor more than \$500."

The expenses incurred in carrying out the provisions of the law "shall be met as other expenses of cruising or caring for the state lands." The items in the appropriation act for the two years ending March 31, 1905, out of which one must suppose these expenses are to be paid, are as follows, namely: "Salary and expenses of agents selecting lands, and United States Land Office fees, \$12,000. Appraisalment, sale and lease of state lands, \$20,000."

ONTARIO.

The Province of Ontario having more than twice the territorial extent of Minnesota, with extensive forests, her system of fire prevention should be of particular interest. As early as 1878 a law for the prevention of forest fires was enacted, but, not providing means for its enforcement, it became, to a great extent, a dead letter; and in that condition matters remained until the year 1885, when a system was devised by the Crown Land Department for the employment of rangers to be appointed by that department on the recommendation of the "timber licensees" or lumbermen—the lumbermen to pay half the expense of the service and the government half. For some years the government advanced pay for the whole cost and undertook to collect one-half of the expense from the lumbermen, but now the lumbermen pay their half direct to the rangers. The system remained simply one of practice until the year 1900, when it was enacted as a law. Under this law, for the prevention and suppression of fires on the lands of the Crown not under timber license,

the Commissioner of Crown Lands may appoint such number of persons as he may see fit, to be called fire rangers, who shall be subject to his instructions, and may pay them for their services out of any moneys voted by the Legislative Assembly therefor. Where Crown lands are under timber license or other form of authority to cut or remove the timber therefrom the Commissioner may appoint such number of fire rangers as the timber licensee or holder of such other form of authority may request, and in the absence of such request the Commissioner may appoint such number of rangers as the public interest requires; "and in such cases one-half of the remuneration to be paid such fire rangers and one-half of the expenses necessarily incurred by them in the performance of their duties shall be payable by the licensee or holder of authority as aforesaid, and one-half by the said Commissioner out of the moneys voted by the Legislative Assembly for the purpose; or the said Commissioner may pay the whole amount of such remuneration and expenses, and may charge the timber licensee or holder of authority as aforesaid with one-half the said amount, which shall be and remain a charge on the timber limit or other area covered by said authority until paid, as fully and effectually as if the same were for unpaid timber dues or ground rent, and in respect of the recovery thereof the said Commissioner shall have all the rights, powers and authority now possessed by him for the recovery of unpaid timber dues or ground rent under the Crown Timber Regulations or otherwise."

The fire rangers are required to enforce the law "and in all cases coming within their knowledge to prosecute every person found guilty of a breach thereof." They may summon such help for the prevention and suppression of fire as they may deem necessary, and all persons so summoned and helping shall receive such remuneration



Lake Superior Forest Reserve. View from elevation of 70 feet on south bank of Isabeln River, July 12, 1903. Photographed for the annual report of the Chief Fire Warden of Minnesota.

as the fire ranger or rangers may deem proper. The fire rangers shall perform such other duties and receive such wages as may be provided by regulations to be made under the Act by the Lieutenant Governor in Council.

By order in Council the government can appoint a ranger as magistrate, if competent, and he is able to appoint his assistant a constable to assist in arresting and bringing to justice people who violate the Act. The Ontario system appears to give good satisfaction. In 1886 the number of rangers employed was 45 and the cost \$9,847, half of which was borne by the licensees. The service grew so that in 1902 the number of rangers was 234 and the government's part of the expense was \$34,200. Forty fires were reported that year and 10,000,000 feet of pine were damaged, the estimated loss being \$10,000. In 1903 the government's part of the expense was \$31,257. The number of rangers employed was 270—May 1 to September 30—of whom 244 were employed on licensed lands, the licensees (timber cutters) paying half the expense.

There is another law in Ontario by which on the petition of one-third of the ratepayers a town may appoint not less than two fire guardians to prevent and extinguish fires set on land.

MINNESOTA.

It will be seen from the foregoing that there was important legislation in several states in 1903 for the prevention and extinguishment of forest fires. The effect of such legislation will be watched with interest. The system in Ontario appears to be one of the most liberally sustained of any. I think the criticism which an experienced legislator would make of some of the systems would be their failure to sufficiently provide for the payment of fire warden service. It has been my impression that towns would not have money in their treasury for the

payment of fire warden expenses unless the money were specifically raised for the purpose. To raise money for such purpose would require a vote at the annual town meeting and the proposition might fail just in the towns where the money was most needed.

The Minnesota system makes the State Auditor Forest Commissioner and authorizes him to appoint a Chief Fire Warden to represent his authority. Supervisors of towns, mayors of cities and presidents of village councils are constituted fire wardens. Chapter 64 of the laws of 1903 changes the manner of electing supervisors, so that after three years from now each will hold his office for three years instead of one year as heretofore. The act provides that "there shall be elected in the year 1904, at the annual town meeting in each town, three supervisors, one of whom shall be elected for three years, one for two years and one for one year, so that one shall go out each year. * * * At each annual town meeting thereafter one supervisor shall be elected for three years to fill the place of the one whose term expires at that time." This law secures increased experience in the supervisors, and of course should make them more efficient as fire wardens.

In unorganized territory the Chief Fire Warden appoints necessary fire wardens, and he may appoint needed fire wardens in any organized town. In brief, the fire wardens are to take precautions to prevent fires, post notices, warn those whom they think are liable to be careless, patrol or cause to be patrolled their districts in dangerous weather, go to and extinguish forest or prairie fires when they occur, and they have power to call to their assistance any able-bodied male person over 18 years of age. They are to make complaint before a justice of the peace against anyone carelessly causing a fire where they have information of facts that will probably sustain the same.

The chairman has to inquire into the cause of each fire without delay and immediately report the same to the Chief Fire Warden with other facts. Fire warden service is paid for in the first instance by the county commissioners, and the state afterwards pays the county two-thirds of the amount. Besides, the law carries an annual appropriation of \$5,000 to enable the Chief Fire Warden to prevent or suppress forest and prairie fires, "during a dry and dangerous season, when forest and prairie fires are prevailing or are liable to break out"; also an annual appropriation of \$1,000 to enable him to ferret out and prosecute violations of the law where local authorities neglect to prosecute them. This is but a short summary of the law, which was strengthened by twelve amendments enacted by the last legislature, and which were printed in full in my previous report.

I think the principal weakness of our Minnesota system has been the uncertainty of pay for fire warden service. In a few counties the commissioners have in previous years arbitrarily refused to pay for any service. In other counties fire wardens have been humiliated by having accounts that were already small unreasonably cut down. I must say that the service has been considerably impaired by the illiberal action of county commissioners. I have heard quite able and experienced men say that it would be better if the state were to pay the whole expense. However, the tendency appears to be towards more considerate action by county commissioners, and now that the state pays two-thirds of the expense I think it may be hoped that the fire wardens will be promptly and fairly paid for their services. Anyhow the new provision of law should have a fair trial.

EXPENSE OF MINNESOTA'S FIRE WARDEN SYSTEM.

The State Auditor's printed reports show the expenditures under the fire warden law. The expenses which the various counties have incurred under the law has averaged only \$2,000 a year, and the expense which the state has incurred has averaged about \$6,000 in round numbers. Total \$8,000; of which at least \$1,500 a year has been incurred for printing. We have seen that the expense of Ontario's system for preventing and suppressing forest fires amounted to, in 1902, \$68,400, half of which was paid by the Government. For actual work in the field, therefore, Minnesota has expended only about a fifth part as much as the Government of Ontario. I am satisfied that if the appropriations for fire warden service were more liberal, and if fire wardens could be certain of reasonable compensation, the service would be more efficient.

The reports of fire wardens during the eight years that the fire warden law has been in operation show that the number of acres burned over by forest fires amounted in the aggregate for the eight years to 370,613, but consisting mostly of cut-over land and meadows; and that the damage amounted in the aggregate to \$251,602, being an average of \$31,200 per year.

VERY DANGEROUS WEATHER.

Let us imagine that we are in the midst of a very dangerous season; that there has been no rain for about a month and that everything in the woods is in a combustible condition. Campers and tourists, hunters, land seekers, mineral prospectors and cruisers are all active, and in hundreds of places some new settler may be engaged in clearing land. The risk of fire will be very great. Under such conditions what are the fire wardens to do? They should have seasonably warned any care-

lessly disposed persons against setting fires; they should cause their districts to be patrolled as they have authority to do, and they should be especially active in having any forest fire extinguished at the earliest moment and before it gets beyond control. But suppose a fire has gained considerable headway and is burning over several acres of fallen timber and slashings and is really such a fire as cannot be extinguished? If a gale should rise such a fire would be likely to spread and cause disaster. Then in such a case the fire wardens should try to have plenty help, and before the wind has risen go a sufficient distance in advance of the fire and make an extra sufficient fire break. This had better be done in the evening or very early in the morning, when the weather is likely to be calm. In making a fire break in such case advantage should be taken of any natural formation, such as a stream, hillside or road.

The fire wardens of a town should, before there is danger of any fire, carefully consult together and agree upon the best plan of action to be taken at a critical moment. They should be just as well prepared as possible for an emergency, and if they seasonably think the matter over seriously they will realize how important is the prevention of fires. One thing which they certainly can do is to make themselves familiar with the fire warden law, so as to know what their duties are.

Town supervisors as fire wardens now have plenty of authority, and they will be responsible for dangerous fires originating in their town.

Under the present law fire wardens and those who assist them can be reasonably sure of their pay. The state, as before said, now pays two-thirds of the local expense which counties incur for fire warden service; and there is besides a fund of \$5,000 which the state will directly expend if necessary for the prevention and extinguishment

of fires in a dry and dangerous season. This, it must be remembered, is for an extraordinary season. For ordinary seasons the appropriation, as I have stated at the beginning of this report, should be increased.

WHAT IS FOREST PRESERVATION.

The greater part of the standing timber in this country belongs to private owners, who will cut it as fast as they find a good market.

When a timber tree has ceased to earn good interest by its growth, it has reached its fiscal age, and ought to be cut.

What we mean, then, by forest preservation is the protection of forests from fire, the reservation and treatment on forestry principles of such of the remaining public timber lands as are better adapted for forestry than for agriculture, and the acquisition by states by purchase of any considerable tracts of private nonagricultural lands in their limits, especially at the sources of rivers, and holding and using the same for forestry.

Strictly speaking, forestry looks only at dollars and cents. At the same time, it yields indirect benefits which concern everyone. The forest beautifies landscape, improves climate, enriches soil, maintains water courses, makes covert for game, affords means of recreation.

The significance of forestry is that it utilizes waste land—land that is too hilly, too rocky or too sandy for agriculture. If a forest of pine should now be started on such land it would in eighty years reach merchantable size. The population of this country increases eighteen per cent every ten years. By the time the forest had matured our population would be 287,000,000. What an increased demand for forest products at that period!

THE ORIGINAL PINE FORESTS DISAPPEAR.

One of the richest pine timber regions of the northwest was the Saginaw and Huron Shore districts of Michigan. In 1893 there was cut in that district, 858,000,000 feet of pine; but the supply of pine timber had so diminished during the next ten years that in 1903 only 52,000,000 feet were cut. The number of feet of pine logs cut in Minnesota the season 1902-1903 was 2,000,000,000. The amount of pine lumber cut in the year 1903 by the mills in the districts of Duluth, Minneapolis, above Minneapolis and St. Croix was 2,200,628,000 feet; being over two billion feet. A comparatively small amount of this may have been from the forests of Wisconsin. A liberal estimate places the remaining standing pine in Minnesota at 28,000,000,000 feet. Anyone can judge for himself therefore, how soon this forest capital will be exhausted and say whether it is not time to begin a system of reforestation by utilizing waste land in the production of pine timber.

PRACTICAL FORESTRY.

In a certain sense it is forestry when we cultivate trees for a wind break on the prairie or to add beauty to a lawn or to prevent the earth from washing away on steep hill-sides; but strictly speaking forestry is the science of raising timber trees for profit. Forestry is the science of deriving good money returns from land which cannot profitably be cultivated in raising grain or other field crops.

Let us suppose that the state or some institution of learning holds a thousand acres of natural forest, that it does not need to convert the timber immediately into money but is able to treat it on scientific forestry principles. Now, how will it begin to manage this forest?

That depends upon the character of the soil, the size of the timber and the condition of the lumber market. An examination of the forest by a skilled forester shows that 500 acres, or one-half of it, consists of mixed pine and hardwood timber growing on good loamy soil with clay subsoil suitable when cleared for agriculture; and that the other half consists of wholly pine forest on soil that is too sandy for agriculture.

We are to assume all the while that this forest is to be treated so as to yield, not for to-day only, but for a long series of years, the largest financial return without impairment of the capital; in other words, we are not to kill the goose that lays the golden egg. Very well, how then shall we proceed? We are to suppose that the half of the forest on good soil contains yellow birch, basswood, maple, poplar and some oak trees, mixed with considerable pine; and the pine is from 80 to 100 years old, of good merchantable size, and that it is not earning by its growth more than about two per cent interest on its value; that most of the hardwood trees are mature, that many of them are suitable for timber and the balance good for fuel. Now, it is plain that if these trees are within reasonable reach of a market and there is a fair demand for such timber then they should all be cut and their value turned into money at the first convenient period, and that the land on which they stand should be used in the future for raising wheat, grass or some other field crop. Because, of course, a larger income can be got from the land in raising annual field crops than in raising crops of trees, which on such land would require 50 years to reach merchantable size.

Now, about the other half of the forest on sandy soil which is too light for farming purposes. On these 500 acres we find that the trees are mostly red pine, commonly called Norway pine (improperly so-called however,



An ideal forest of Norway pine and thick undergrowth of white pine, from one to three feet high, on the island in Cass Lake. Photographed, September, 1900, for the annual report of the Chief Fire Warden of Minnesota.

because the pine of Norway is the same as the Scotch pine), and here and there a few white pines. The trees are for the most part only about fifty years old, stand pretty close and are earning fully five per cent interest net by their growth. The proper thing to do with them therefore is to let them remain about thirty years longer, at the end of which time they will be from 12 to 15 inches in diameter breast high and can then be cut and sold to the best advantage. At that period they can be said to have reached their fiscal age, because after trees are eighty years old their growth is too slow to yield good interest. As the soil is only fit for bearing pine these trees when cut should be succeeded by another crop of pine, and so on perpetually; and doubtless the best economy will be to cut them gradually, fifty acres or so a year,—and beginning always on the side opposite to the prevailing winds—so that the ground can become reseeded from the adjoining trees and a new crop raised naturally. If, however, a new crop does not start naturally, then cutting must be followed either by sowing seeds in spots, three to five feet apart over the ground, or by planting seedlings or transplants about the same distance apart. If young trees come up naturally from the seed as abundantly as they should there will be about one thousand trees on each acre when they are 40 years old; at which age if a thinning is made by cutting and removing the poor, deformed and diseased trees the rest will grow in a more thrifty manner.

Of course care must be taken that this perpetual forest shall not be damaged by fire. A good plan for this object would be to maintain a road around the forest.

Managed according to forestry principles this 500-acre tract of sandy non-agricultural land will perpetually yield three per cent net compound interest annually on the capital it represents.

A NORMAL FOREST.

The best treatment, however, of this five hundred acre tract of perpetual forest would be to get it into the condition of a normal forest at the earliest practicable period. A normal forest is one that is fully stocked, that contains different age classes of trees, so that enough mature trees can be cut annually or in a certain series of years to yield a steady income on the capital invested without impairment of the capital. The rotation period for pine on such soil should be eighty years; and as soon as this forest is in a normal condition six and a quarter acres of mature timber can be cut annually for ever. An acre of such forest should, at the end of its eighty years' growth, yield on an average 20,000 feet board measure. The yield of six and a quarter acres therefore would be 124,000 feet, which at \$5 per 1,000 feet would amount to \$620 as the annual gross income from the forest, exclusive of intermediate thinnings and fishing and hunting privileges. From this gross income of \$620 deduct \$124 as the annual average expense of care of the forest, also taxes (which on sound principles should only be on the revenue), and we have left \$496 as the net amount of annual interest, at three per cent, on a capital of \$16,530, representing the value of the forest.

Forestry enjoys this advantage over agriculture: The field crop must be harvested when ripe, even though market prices are ruinous; but the forest crop can stand and grow, if only a little, till prices are good. It may be expedient not to cut our regular six and one-quarter acres of forest each year, but wait ten years, or even longer, and then, when the market for timber is very good, cut enough to make up for the inactive years.

To bring a forest into a strictly normal state the following rule, cited by Professor William Schlich (*Manual of Forestry*, vol. 3, page 318), can be followed: "If the

normal growing stock is present in a forest, then the actual, or real, increment must be utilized; if the real growing stock is greater than the normal, more than the real increment must be removed; if the real growing stock is smaller than the normal, less than the real increment must be utilized until the deficiency has been made good."

NURSERIES.

If one has to plant many acres with pine or spruce trees it will be economical to raise them in a nursery. In such case the ground for the nursery should be prepared with the same care as for a vegetable garden, but should not be manured. Good natural and rather light loamy soil is the best for a nursery. Seed should be sown in beds, and in rows four to six inches apart, after the frost is out of the ground in the spring and when the ground is not wet. As young coniferous plants are very delicate and liable to be killed by the sun unless shaded, a screen, either of laths or of brush, must be kept over them during the first weeks after they are up. While they remain in the original bed the plants are called "seedlings," but they should not stay in the original beds longer than two years. When one or two years old they can be planted on the ground where they are to remain, or they may be planted and remain one year in other beds, when they are called "transplants," and then planted for forest. Planting had better be done in moist weather. The skilled workman never allows the hair roots of plants or trees to be exposed even for a moment to the sun or dry air.

WHAT FORESTRY MEANS FOR MINNESOTA.

What forestry means for Minnesota is simply this: The remaining original pine timber will be cut in the next fifteen years. Some second growth pine, if protected

from fire, will then be cut from year to year, but it will not be as good as the original growth and there will not be enough of it for home consumption. Lumber will be dearer and our great lumber industry will decline. There are, however, fully three million acres of waste land in scattered localities which if planted with pine would in time become normal forests, yielding forever a supply sufficient for our home need. Such forests would by their growth perpetually yield a net annual revenue on the capital invested of three per cent, compound interest, besides many indirect benefits. On such waste, sandy land it will take on an average about eighty years for a crop of pine trees to grow to merchantable size. Individuals cannot wait so long for a crop and they will not engage in the business. The state, to whom time does not occur, must undertake the work by purchasing waste land and planting it with pine. The Minnesota forestry board is ready to go to work, but, until there is some man in the legislature who will make forestry a specialty and fight for it with energy, we shall not get the necessary money for forestry.

RANK WHICH FORESTRY SCIENCE CAN GIVE OUR COUNTRY.

When thirty years ago the United States sent her naval vessels over distant seas to observe the transit of Venus, Europe gave her the highest praise for such sacrifice for science. Wherever Americans have profited by science they rank with any other people. To keep our army and navy up to date we have maintained scientific military and naval academies for a long period. Homage is paid to our ships of war abroad because our naval service has had every benefit that science could furnish. So, when our forests shall have had scientific care for a sufficient time we shall rank with the most advanced countries in forestry. "A nation's character," said Henry Clay, "is

the sum of its splendid deeds." To clothe the waste places of our country with thrifty revenue-yielding forest would be a splendid deed!

NATIONAL FOREST RESERVES.

The compiled statutes of the United States, page 1539, provide that "no public forest reservation shall be established except to improve and protect the forest within the reservation or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States; but it is not the purpose or intent of these provisions, or of the act providing for such reservations, to authorize the inclusion therein of lands more valuable for the mineral therein, or for agricultural purposes, than for forest purposes."

Any mature timber in a United States forest reserve may be sold at its appraised value. Any person, under the regulations of the Interior Department, can enter a forest reserve for all lawful purposes, including that of prospecting, locating and developing the mineral resources thereof; and, more than that, can have free use of timber and stone carrying on his work. Besides, the Interior Department may restore to the public domain any public lands in a forest reserve, which, after due personal examination by a competent person, shall be found better for mining or for agricultural purposes than for forest use. The setting apart of lands that are suitable for the purpose as a forest reserve is, therefore, beneficial to the public, though it may not be beneficial to the speculator in timber.

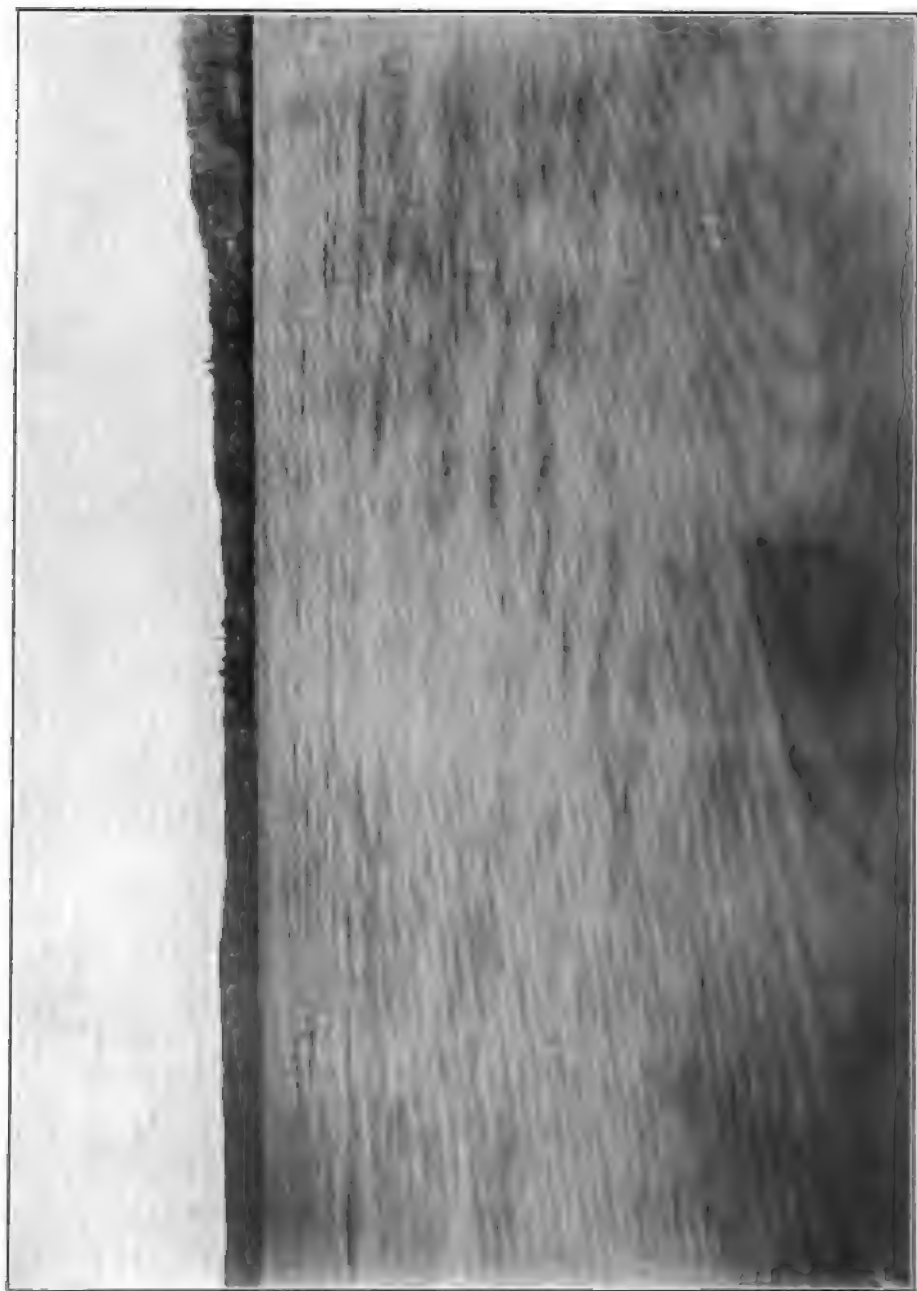
FORESTERS NEEDED.

Some of the brightest young men in Minnesota are studying forestry. The United States government will soon want fully 300 trained foresters to have charge of the

national forest reserves. There are now 62,000,000 acres of such reserves in the Rocky Mountains and farther west, and they are likely to increase. A trained forester is to have charge of a range not exceeding on an average about 170,000 acres—depending somewhat on natural boundaries—at which rate there should be employment now for 360 foresters or chiefs of range, to manage properly the present reserves. But at present there are probably not more than thirty foresters in the country qualified for the position.

Forestry promises to be one of the most attractive of scientific careers for young men in this country. It is a profession in which the tenure will be permanent and the service fairly well paid; but it will require, of course, years of hard study to become qualified for the service. A forester should be a good practical surveyor. He should know how to measure trees and estimate their contents, how to make a map of the forest and necessary roads, how to make and execute working plans for the forest and to manage the same in a way to secure a sustained yield. Besides technical knowledge of trees and tree culture, he must be acquainted with the kindred sciences, such as agriculture, geology, mineralogy and botany. He must know how to protect the forests from the ravages of insects as well as from fire and trespass, how to get rid of noxious animals and how to protect valuable game. These are some of the things he must know.

Assuming that a boy had graduated at the high school, he ought in four years of study and practice, one of which should be a year of practice in the woods, to become a fairly competent forester. With such training I think he would be sure of \$1,200 a year as a forester in the service of the United States, with the prospect of rising in his profession for distinguished merit.



Shore of Little Eagle Lake, Lake Superior Forest Reserve, July 11, 1903. Photographed for the annual report of the Chief Forester of Minnesota.

The appropriations which congress made for the present fiscal year for the care of forest reserves and for the forestry bureau amounted in the aggregate to \$892,000.

LAKE SUPERIOR FOREST RESERVE.

Favored by perfect July weather, my trip into the wilds of Lake County was through a region that could well be called Minnesota's Adirondacks. Embarking four miles east of Ely in two modern canoes, with an experienced canoeman for each, and with a photographer, the route was via the Cashaway and Birch rivers, Gabbro and Bald Eagle lakes, the Isabella river, Lake Bellissima, Elbow and intermediate lakes to Cross river, thence to its mouth at Lake Superior; traversing parts of eleven townships, five of which are unsurveyed, and most of the country being in the proposed Lake Superior Forest Reserve. The surface is undulating with elevations varying from 1600 feet to 2200 above the sea. Granite ledges are frequent and granite boulders often fringe the banks of lakes and streams. The country generally is a handsome primeval forest, with some swamps of dwarf spruce and burnt areas interspersed, the prevailing kind of trees being spruce, balsam, jack pine, white birch, poplar, cedar and tamarack. There is but little of white and Norway pine. Alder bushes abound in low places and along river and lake shores. The ash, elm and maple are seen in more fertile spots, but not frequently. A few spruce and cedars were seen that were a little over two feet in diameter, breast high, but generally the trees are not of large size so far as could be judged in travelling many miles through the woods in the twenty portages—some of which, on account of obscure trails, fallen trees and labyrinth of roots, were difficult. Climbing to an occasional height, an extensive view could be gained of the landscape. The sombre coloring of coniferous woods was relieved by

the lighter foliage of white birch and poplar, and the moving shadows cast by the clouds made an impressive scene.

The region is rich in lakes and streams. Bald Eagle lake, which is about three miles in length and wide in proportion, has such a handsomely wooded sloping shore and fine islands, and looked so cheerful on the bright summer day we entered it, that I thought its name could well be changed to the Lake of Smiles. Bellissima lake is still larger, with more islands and equally as beautiful. There are many other large, fine lakes, some of which are stocked with whitefish.

Over a dozen moose were seen on the trip, always near water, and nearly as many deer. Also ducks and partidges were seen. The country is fairly well stocked with fur-bearing animals, such as the black bear, martin, lynx, otter, beaver and fox. If set apart as a forest reserve the region would prove a great game and fish preserve, and no doubt a favorite resort for tourists. There is any amount of water power in the rivers, especially in Cross river, where the spruce could be made into pulp.

The forest reserve law provides for the utilization at its appraised value of all merchantable timber in a reserve. If any considerable area of agricultural land is found in a forest reserve it is to be restored to the public domain.

ALONG THE RAINY RIVER.

I went the latter part of September, fifty miles through a timber country on the line of the Canadian and Northern Railway from Beaudette to Warroad (on Lake of the Woods), in the northern portion of Beltrami and Roseau counties. The road has been in operation a year, but I saw scarcely any trace of recent fire along the line of route. This was the first time I had visited just that portion of the state, although it was the third time I had visited Rainy River. For the greater part of the distance

the land is suited for agriculture. I would except from the agricultural areas a few tracts that are exclusively in jack pine. It is generally level. The prevailing timber is poplar, then richly tinted and handsomer for scattered basalms and spruce. There are considerable bodies of good spruce; also of cedar and tamarack alternating with some inviting hardwood tracts. There is also some good pine, the manufacture of which at one place at least along the line of road has begun. This timber ought to have an increased value when the great water-power at Koochi-ching—now called International Falls—shall be developed. The agricultural character of the land and the quality and quantity of the timber along the line of this railway on the Ontario side are equally as good.

This railroad is developing quite an important part of northern Minnesota. The scenery of the Rainy River, the islands and shores of which are prettily wooded, is decidedly beautiful, especially after it has received the autumn coloring.

EUROPEAN FORESTRY.

No intelligent friend of forestry supposes that the science of forestry will, for a long time, produce in this country the results which are seen in many of the densely peopled states of Europe, but a knowledge of these splendid results is very instructive and stimulating, and for that reason I have taken pains to diffuse such information. The science of forestry is the same everywhere, but its application depends upon the conditions which are found in different countries. Let us assume that there is a natural coniferous forest on non-agricultural land in Germany in which 75 per cent of the trees are mature and 25 per cent have not reached merchantable size. According to scientific forestry the 75 per cent of mature trees will be cut just as soon as the market would justify and the 25 per cent of trees of unmerchantable size would be left to grow till they should be fit to cut. A similar natural forest in this country would be treated in the same way, if treated according to forestry principles; and some lumbermen, such as those, for example, who hold pine lands in the valley of the St. Croix river or on its tributaries in this state, and who have gone back every fifteen or twenty years to make a second, third or fourth cutting on the same land, are managing their forests in this way. In cases where pine lands are remote from streams of capacity for floating and where the pine is reached by temporary logging railroads, clean cutting is made of both large and small trees; but lumbering of this latter description is in violation of forestry principles. If a trained forester were to commence cutting a mature forest he would not begin on that side of it which is exposed to the prevailing wind, because if

he did every cutting would freshly expose the remaining forest on the side of the cutting to dangers from the wind. Instead of that he would begin on the side opposite the prevailing wind, leaving the forest border, long years hardened to the wind on the windward side, as a protection to the forest. Now, that is a principle of scientific forestry and is just as applicable in this country as in Europe. Again, a trained forester in Germany would manage the cutting so as to promote natural seeding from the nearest trees left standing, and that principle is just as applicable in this country as in Europe. If a person in this country were to begin to manage a natural forest on forestry principles he would first have it surveyed; he would ascertain the number, contents and situation of the mature trees; he would gradually make necessary roads; he would make a map of his forest and prepare working plans for its administration and ascertain where he could sell the mature trees at the highest price; these would be the essentials that he would perform, and he would be doing just the same as a German forester would do with a forest in Germany. Owing to the denser population, cheaper wages, better roads, and very much higher value of land and forest products, the results of forestry are very much different there from what they are in this country, or will be for many years. But the cause of forestry in this country will be greatly promoted by diffusing a knowledge of European forestry; and for that reason I reprint from my last report sketches—obtained at great pains and in many instances direct from the respective governments—of the forests and forestry of several European states. A few sketches have been slightly abridged.

BAVARIA.

STATE FORESTS.

Bavaria, whose attractive capital, Munich, is frequented by so many Americans, has 6,000,000 inhabitants. Its state forests comprise 2,150,000 acres, and are mostly managed as "selection" forests. Large forests are to be found in all parts of the kingdom; but as a general rule the mountainous districts in the south (Alps), the north (Spessart) and northeast (Bohemian forest) are covered with the densest forest. Of the whole area of the country 33 per cent is covered with forest. The prevailing kind of trees, or 77 per cent, are coniferous. The remainder comprise various kinds of deciduous trees—those losing their foliage in winter. Among the conifers, red and white pine are most frequent. Among the deciduous trees the beech occupies the greatest space. The oak is also cultivated quite extensively for tanning purposes. The average estimated value of the forest land is \$50 per acre. The annual aggregate expense of administering the forests (1891) including salaries of officials, wages of workingmen, local taxation, new purchases, etc., amounts to \$4,965,204. The total revenue from the forests the same year amounted to \$8,187,349. Number of acres sown or planted to forests in 1892 was 14,800, more than three-fourths of which area was planted with coniferous trees. In the case of the red pine and the white pine, reforestation is mainly done in the natural way. In the case of the fir (*pinus sylvestris*) it is always effected artificially; in the case of the beech, always in a natural way (seed from standing trees); in the case of the oak, generally by artificial sowing. There is a continuity of forest products and a steady increase of the revenue which the state derives from its forests. This is due, first to an increase of prices, secondly to an increase of the yearly

crop. The latter must chiefly be regarded as a result of the present condition of the forests, which are being and have been steadily improved; also of the economy which was practiced in former times. Where reforestation is effected by seeding from the standing trees, the crop is generally cut in lengthy strips, usually not exceeding about thirty yards in width. As a general rule the administration of the state forests makes it a principle to avoid cutting in large blocks clean. In regard to compulsory tree planting, it may be said that every forest area, the trees of which have been cut, no matter whether state or private property, must be reforested in a short time, unless evidence can be furnished that the land would be better adapted to agricultural purposes.

The damage caused by forest fires is quite insignificant, being in 1890 only \$974, in 1894 only \$1,686. The principal cause of such fires is the carelessness of the workingmen employed in the forests and of individuals and parties making excursions, particularly on Sundays. There are no data at hand as to the number of such fires caused by railroad locomotives, and although some fires are no doubt so caused, the number is certainly very small.

The administration of the Bavarian state forests constitutes one of the departments of the ministry of finance. It is directly subordinate and responsible to the latter, no other authorities intervening. The highest forest official who may be regarded as being at the head of the forest administration, responsible, of course, as stated, to the minister of finance, bears the title "Ministerialrath,"—ministerial or cabinet councilor. The chief director of the Bavarian administration of state forests is "Ministerialrath" Ganghofer. His starting salary is 7,740 marks. After a sixteen years' service the salary advances to 8,820 marks. Next in rank are the so-called "Oberforstrathe," with a starting salary of 6,660 marks, which, after a sixteen years' service, is increased to 7,740 marks.

PRIVATE FORESTS.

The aggregate extent of private forests was 3,149,400 acres in 1892. In addition to the state and private forests there are about 800,000 acres of forests belonging to separate towns and villages. The forests which are owned by great landholders are managed on forestry principles. These forests, however, only comprise a very limited area, somewhat less than 400,000 acres. Most of the private forests are the property of small landholders. The average value per acre of private forests is somewhat less than that of the state forests. The net income rate varies widely. The data at hand are too few and too unreliable to admit of arriving at any conclusion with regard to the average. Opinions vary as to whether the total forest product of the country increases or decreases. In general the extent of the private forests seems to be somewhat decreasing. This would, of course, also appear to entail a decrease of the total forest product. Forest lands are only allowed to be changed into agricultural lands when proof can be furnished that the agricultural crop may be expected to exceed in value the forest crop. Between 1886 and 1891 7,000 to 8,000 acres of private forests were newly planted or sown.

DENMARK.

STATE FORESTS.

The experience of a country which had adopted important forestry regulations almost at the very beginning of the last century and which has successfully, through tree planting, resisted the invasion of desolating sand drifts from the sea shore must prove of much value. It was, therefore, with a high degree of satisfaction that I lately received from the Department of Agriculture of





Young and mature Norway pine on a school section (given to the State of Minnesota by the United States) in Beltrami County. Illustrates what many misinformed people deny, that pine will succeed pine if circumstances are favorable. Gradual clearing and gradual admission of sun are generally followed by the introduction and ultimate crown of all conifers. Photographed, 1926, for the annual report of the Chief Forester of

Denmark, answers kindly furnished in the English language to some questions that I had submitted. I have put the information in its present form.

The aggregate extent of the state forests of Denmark is 142,140 acres, besides 2,962 acres for public parks. Of these, 67,700 acres are old forests, 74,440 acres are new plantations, especially on heathy tracts. The planting of forests had already commenced one hundred years ago, but has quite particularly increased since 1850. Forty-five per cent of the state forests are situated on the Danish islands; 54 per cent on the peninsula of Jutland, of which latter only 10.6 per cent are old forests, the rest are new heath plantations not yet thoroughly planted up. Beech comprises 37.7 per cent, oak 3.3, ash, maple, birch, elm and alder 4.8 per cent, and conifers 54.2 per cent. Conifers did not exist in Denmark 150 years ago, so that the extensive area of conifers in the state forests at present has been produced artificially. For the planting up of heaths the mountain pine (*pinus montana*) and the spruce (*picea excelsa*) are particularly utilized. The annual aggregate expense of administration averaged \$40,000 per year for the period 1893-97. Annual aggregate revenue averaged per year for the period 1893-97: revenue \$258,416, expenses \$195,370. The smallness of the net revenue arises partly from the fact that about half of the state forests are still so young as to yield only a small revenue, partly from extensive new areas being cultivated every year. The area annually sown or planted to forest averaged 2,285 acres per year for the period 1897-1900. Regeneration from self-sown seed is only used in the case of the beech (*fagus silvatica*) and of the silver fir (*abies pectinata*). In all other cases, forests are regenerated by means of planting plants or sowing seeds.

There is a sustained yield. Every tenth year a working plan is prepared for cuttings and cultivations of the next decennium. In working out these plans it is taken

into consideration, as far as may be, that there should be such areas and stocks of wood in store for the future as are available for the decennium. Within such a decennial period the yield of the cuttings varies according to circumstances; as a rule, however, there is but little differing one from the other. The extent of the state forests being on the increase, the proceeds will naturally increase. The forests are divided into parts of 10—100 acres in size, according to the nature of the soil or the species and age of the stock of wood. Within each decennial period a certain number of such divisions are destined for cutting, and the latter is commonly to be finished and the areas restocked with plants at the end of the period.

Private persons are prohibited by the law of September 27, 1805, from cutting away those remnants of the old forests of the country still existing in the said year. In cases of offence, means are placed in the hands of the government to force the owners to restock the cleared area under control of the state officer in charge. Consequently but very few forest areas have disappeared in the course of the nineteenth century. The many new plantations in Jutland which have risen by means of government subventions disbursed through the "Hedeselskabet," are subject to the same prohibition of clearing. Finally, under the guidance of a board of administration not appertaining to the state forestry service, the government has caused the waste sandy downs on the west coast of Jutland to be planted in order to subdue the sand drift in those parts, which had in former times caused great devastation. At the close of 1899 about 27,000 acres of sand downs had been planted with a good result. Damages by forest fires occur every year, but they have hitherto been rather insignificant. On account of the dense population of the country the casual forest fires are quickly quenched. The principal cause of such fires is care-

lessness of various kinds. It is notorious that several forest fires have been caused by sparks from locomotives, but no number can be stated.

The administration of the state forests is under the Department of Agriculture; its yearly budget is voted under the general budget of finances and its officers are appointed by the king. The state forestry is managed by three forest masters, twenty-three superior foresters, sixty-nine foresters and 306 keepers. The superior foresters have the use of a house free of charge, together with a lot of arable land (30-100 acres) upon which they pay the ordinary taxes, besides a salary of \$950-\$1,250. The salary of the forest masters is \$1,450, to which is added an allowance for traveling and other lawful expenses. The three forest masters give in an annual report on the operations of the local ranges under their supervision. Three reports are prepared in the department and printed in a condensed form as a supplement to the public accounts. Every tenth year is issued a review of the state forestry in the past decennium. The "Tidskrift Skovvasen" (forestry periodical), published in Copenhagen by Mr. C. V. Prytz, professor of forestry in the Royal Agricultural and Forestry Academy, and "Hedeselskabets Tidskrift" (periodical of the society for the cultivation of heaths), published by "Det danske Hedeselskab" at Aarhus, are the periodicals. The revision of the decennial working plans for state forestry, which is simultaneous with the preparation of the working plan for the next ten years, is undertaken by a "Skovtaxator" (appraiser of forests), classed directly under the department, and four assistant clerks. A second "Skovtaxator" with one clerk is constantly occupied in the experimental line, in examinations of the growth of trees and the economy of divers modes of forest husbanding, altogether in support of practical forestry.

PRIVATE FORESTS.

The aggregate extent of private forests is 505,900 acres, of which, by the statistics of 1896, beech (*fagus silvatica*) comprises 44 per cent; oak, ash, maple, birch and alder comprise 18 per cent, and spruce (*picea excelsa*), pine (*pinus sylvestris* and *montana*), silver fir (*abies pectinata*), larch (*larix Europea*), etc., 38 per cent. Three-fourths to four-fifths of these forests are managed on forestry principles. The extent of private forests by the official statistics was, in 1888, 414,837 acres, and, in 1896, 454,874 acres. By the law of September 27, 1805, before mentioned, and which is still in force, private persons are prohibited from cutting their parts of the old forests of the country standing at that time, aggregating at that date an area of about 280,000 acres. This area comprises (besides the old forest area of the state, about 100,000 acres) the remnants of the original forests of the country still existing. Since 1850 very considerable areas have been planted with forests, both by the state and by private persons, especially in the heathy tracts of the peninsula of Jutland. In these tracts an area of 108,500 acres has, since 1868, been planted by private persons, however under the guidance and control of the "Hedeslskab" (society for the cultivation of heaths), which is aided by the state (for the year 1900 to the extent of \$73,000); and of the above area 54,600 acres were thoroughly cultivated at the close of 1898.

FRANCE.

The total extent of the forests of France (exclusive of the colonies) is about 23,500,000 acres, which represents about 17 per cent of the surface of the entire territory.

These forests are divided in: Forests of the state, 2,700,000 acres; forests of the municipalities and of the public

institutions, 4,700,000 acres; forests of individuals, 16,100,000 acres. The forests of the state and those of the municipalities and of the public institutions are managed and supervised by the Administration of Forests. France only extends over 9 degrees in latitude, but, as it has very high chains of mountains, the result is that it possesses all the climates of Europe, from the hottest to the coldest, and that a great variety exists in the species of trees that compose the forests.

The principal varieties of these species are: In the warm region, comprising the borders of the Mediterranean sea and of the Gulf of Gascony, the cork oak (*quercus suber*), the evergreen oak (*quercus ilex*), the cluster pine (*pinus pinaster*) and the Aleppo pine (*pinus halepensis*).

In the temperate region, comprising the plains, the rolling grounds and the lower parts of the mountains, the common European oak (*quercus ruber*), the European white oak (*quercus pedunculata*), the beech (*fagus silvatica*), the hornbeam (*carpinus betulus*), the common European ash (*fraxinus excelsior*).

In the cold region, comprising the middle and upper parts of the mountains, up to the extreme limit of vegetation, the silver fir (*abies pectinata*), the Norway spruce fir (*abies excelsa*), the beech (*fagus silvatica*), the Scotch pine (*pinus sylvestris*), the mountain pine (*pinus montana*), the larch (*larix Europea*).

STATE FORESTS.

The total area of the forests of the state, 2,700,000 acres, is composed of 2,100,000 acres of productive forests and of 600,000 acres of protective forests, situated in the mountains or on the dunes of the ocean; of lands recently purchased by the state on the banks of torrents and whereon timber is now being planted.

The forests yield annually to the state:

Timber (cubic feet)	33,800,000
Fire wood (cubic feet).....	62,300,000
Total	96,100,000

This represents nearly an annual production of 46 cubic feet of wood per acre of productive forest. The state forests produce in addition thereto oak bark, which is used in the tanning of leather; cork, rosin and several other small products; also hunting rights are leased.

The gross annual income in money is \$5,500,000, or \$2.62 per acre of producing forest. In some forests this average is largely exceeded and it attains as high as \$8 per acre.

The expenses are as follows, viz.:

Labor.....	\$1,240,000
Forest instruction	35,000
Sundry works.....	360,000
Reforestation of mountains	700,000
Taxes paid to departments and municipalities.....	360,000
Sundry expenses	60,000
Total	\$2,755,000

But of all these expenses a large share is applied either in administering the forests of the municipalities or in executing works of real public utility in the "protection forests," or in reforestation mountain lands (to prevent slides and the like). If we make these several deductions we find that the expenses incurred in the producing forests do not exceed \$1,500,000 or 71 cents per acre. The net annual income of these forests is therefore \$2.62 less 71 cents, equal to \$1.91 per acre.

The state forests are carried on either as high forest or as coppice, and are managed under regulations made by the President of the Republic. Cuttings are made yearly. In forests rich in wood there is cut every year an amount equal to the increment or growth; in forests poor in wood

they cut less than the increment in order to gradually increase the forest. The endeavor is made also to increase the production of the timber wood by reducing that of the fire wood. The "high tree forests" are cut down at periods ranging from 120 to 150 years.

The work is directed in a way that will insure natural reforestation from the seeds that fall from the standing trees. Not only the trees that have attained the age determined by the rules are cut down, but also the dead ones and those which are dying, and those that prevent the growth of neighboring trees. In temperate climate the annual cutting of high trees is on a limited area; a large number of trees are cut down simultaneously. In very cold climates and where winds are to be feared, only a few trees are taken away at a time on the same point, and cutting is then done on a larger area.

The low forest, coppice and second growth are cut in rotations, ranging from 25 to 35 years. The reserved trees, which are very numerous, are cut on an average every 100 years, but some selected trees are allowed to attain and even pass 200 years.

The labor performed in the forests consists in the construction and maintenance of forest roads, water saw-mills, houses for watchmen, replanting. Fortunately, owing to the system of culture now in use, artificial reforestation has but little importance in forests, properly speaking, but sowing and planting in the small open spaces, or on the points where a few more valuable species are to be introduced, or where the soil of the forest is better adapted to some varieties, there sowing and planting are more frequent. The average cost of such work is \$10.00 per acre.

Very considerable reforestation is made on mountain lands, where the state plants trees to regulate the action of the waters and stop the ravages of torrents. For that purpose \$700,000 are expended every year, the

largest part of which is used in the purchase of land, and the other part in dams to regulate the streams, and in plantations to settle and retain the soil. The state purchases yearly, on an average, 16,000 acres. The average cost of reforestation is \$20 per acre, and \$18 must be added thereto for work in improving the streams, building roads, etc. Planting is preferred to sowing on calcareous or chalky soil.

The administration of the forests forms part of the Department of Agriculture. It has charge not only of the direction and care of the forests of the state and of those belonging to municipal corporations and public institutions, but also the overseeing of the fishing in the rivers and creeks. At its head is a director, residing in Paris, who has under him: A central service composed of 3 administering general inspectors, 10 inspectors, 5 assistant inspectors and 17 clerks.

An exterior service composed of:

First—Personnel superior or of administration—32 forest keepers, 200 inspectors, 215 assistant inspectors, 250 general wardens.

Second—Personnel inferior or of surveillance—3,500 foremen and wardens, paid by the state; 3,700 foremen and wardens, paid by the municipal corporations and public institutions.

The annual salaries paid are as follows:

SUPERIOR OFFICIALS.

Director.....	\$3,000
Administrators.....	1,800 to 2,600
Forest keepers.....	1,600 to 2,400
Inspectors.....	800 to 1,200
Assistant inspectors.....	600 to 800
General wardens.....	300 to 520

Exclusive of some additional allowances for traveling expenses.



pine on the south shore of Cass Lake. Some of Minnesota's most charming scenery. Photographed, 1899, for the annual report of the Chief Fire Warden of Minnesota.

INFERIOR OFFICIALS.

Foremen and wardens paid by the state an average of ..	\$160.00
Foremen and wardens paid by the municipal corporations and public institutions	116.00

The foremen and wardens receive in addition thereto allowances of firewood, tillable land, pasture grounds, etc.

Those in the employment of the state have free rent in houses built in the forest, or in lieu thereof they receive as compensation a cash equivalent.

The superior officials are entitled to a retreat pension at the age of 60 years, and the inferior officials at the age of 55 years.

France has three forestry schools. One school of higher instruction at Nancy; one school of secondary instruction, and one school of primary instruction. The two latter schools are established in the department of Loiret, on the possessions of the administration at Barres.

FORESTS OF MUNICIPAL CORPORATIONS AND OF PUBLIC INSTITUTIONS.

The forests of municipal corporations and of public institutions comprise 4,700,000 acres. They are supervised by the Forest Service on the same conditions and according to the same principles as the state forests. They contain about 200,000 acres of forests for protection, and their producing area is thereby reduced to 4,500,000 acres. They produce annually, timber, 42,000,000 cubic feet; fire wood, 128,000,000 cubic feet, and together, 170,000,000 cubic feet. This represents nearly an annual production in wood of 38 cubic feet per acre of productive forest. The annual cash value of the product, including the bark, cork and rosin, is \$6,400,000, or \$1.42 gross income per acre. The net income is about \$1.14 per acre. The forests belonging to the municipalities and public institutions are under regulations approved by the president of the republic. These regulations and those of the state

forests have been established with a view of insuring a continuous annual production and even of increasing that production in the forests where it is not yet sufficient.

PRIVATE FORESTS.

Private individuals are at liberty to manage their forests as they please. But they are prohibited from cutting and taking trees from forests which are necessary to maintain and regulate water flow, to protect lands against the encroachments of the sea and sands, to defend the territory, or which are necessary for the public health. The destruction of private forests has become rarer and rarer and the proprietors acknowledge now that on soils of poor quality the income from forests is greater than that from arable land. As a result the area of private forests, instead of decreasing, increases from year to year by reason of the timbering of lands on which agriculture pays but small profits.

The income from private forests in quantity and in money is not exactly known. It is, however, known that on the same area they pay less than the state forests. Private individuals in their anxiety to get returns are inclined to cut down the wood when it is too young, and in the forests where coppice wood is raised they do not leave a sufficient reserve, and oftentimes leave none at all. One can notice, however, that the principles of silviculture are spreading more and more in the culture of private forests. The large forests are subjected to the same mode of management and are treated like the state or municipal forests. On the whole the annual production is regular and tends to become better in both quantity and quality.

FOREST FIRES.

In the temperate and in the cold regions of France (that is, in the larger portion of the territory) the fires are but few and cause slight damage. The long periods of

drought are not frequent, the numerous roads that run through the forests make very good lines of defense, and the villages that surround the massive wooded areas furnish at the first alarm devoted laborers. The railroad companies, being held responsible for damage by fire caused by flying sparks from their locomotives, take particular care, and in exposed places cut the grass and brush along their roadbeds.

The forestry code forbids, under penalty of \$4 to \$20, carrying or lighting matches in or within a distance of 200 metres from the forests.

In the forest camps of the state, municipal corporations or public institutions, it is forbidden to the workers to light fire outside of the buildings or shops, the location whereof is indicated by the forest service.

In the warm region the dangers from fires are greater. As a preventative against them more roads are built, trenches 20 to 50 metres wide and kept free from grass and brush are made around the forest, along railroad lines, on the dividing lines between forests belonging to several owners, and also from distance to distance in the large and dense forests belonging to the same proprietor. The use of fire in forest camps and in agricultural camps situated within 200 meters from the forests is forbidden during the months of June, July, August and September. A special watch is organized, and telegraphic lines penetrating the center of the forests admit of alarm of fire at its start and call for help. If the working force appears to be insufficient the military authority furnishes the deficiency and sends on the spot soldiers who act according to the directions of the forest service.

COLONIES.

France, fully convinced that the preservation of forests is in all lands of the highest importance, has organized a forest service in its possessions outside of Europe—in Al-

geria, Tunis, Madagascar, Indo-China, Reunion. In Algeria the organization is exactly similar to that of France, and calls for an annual expenditure for salaries and works of \$600,000.

HESSE-DARMSTADT.

STATE FORESTS.

The state forests of the Grand Duchy of Hesse-Darmstadt occupy 165,000 acres, and are situated in the Rhine valley (on alluvial sand), in the Vogelsberg mountains (on basalt and red sandstone), and in the Odenwald mountains (on granite, syenite and red sandstone). The prevailing species are beech, occupying 40 per cent, Scotch pine, occupying 34 per cent, and oak, occupying 16 per cent of the area under forest; whilst the remaining 10 per cent consist of spruce, fir, larch, alder and birch forest. It is a noteworthy fact, proved from the writings of Cæsar, Tacitus and of early German authors, that there were no coniferous trees present in their time except yew. Pine was introduced only from the 15th century on. The average value per acre is about \$100; but there are great differences according to quality of soil, transportation facilities and density of population. The annual aggregate expense of administration is \$148,500; and the annual aggregate revenue is \$561,000. There are planted annually to forest 750 acres, the planting extending over the entire surface of the ground. On 2,500 acres, according as "blanks" in natural regenerations are stocked, partial planting takes place. There are used on an average per annum: 110,000 pounds of seeds of broad leaved species; 4,000 pounds of seeds of coniferous species; 5,000,000 broad leaved seedlings; 5,000,000 coniferous seedlings. The annual expense for starting new generations of trees

aggregates \$22,000. Beech is invariably raised from the seed dropping from mother trees evenly distributed. Scotch pine is planted when one year old, over 10,000 seedlings being used for each acre. Spruce and fir are planted when four years old, or seeds are sown in strips being about four feet apart. Oak is either planted as a seedling two feet to three feet high, or acorns are dibbed in, the method used depending on local conditions. All plants are raised in forest nurseries, kept under the care of local forest rangers. Comparatively large areas are covered with oak-coppice forest, which is copped every 15 to 20 years, with a view of obtaining tanning bark. White pine and douglas fir have been introduced with splendid success. American red oak and hickory seem to answer the local conditions fairly well.

In certain densely populated sections, where soil fit for agriculture is scarce, field crops (potatoes and rye) are raised together with tree crops during the first three to five years following the cutting of mature trees. Rows of potatoes alternating with rows of pine seedlings are frequently seen. This combination reduces the expense of reforestation. It secures for the seedlings a soil of high porosity, whilst it exhausts, on the other hand, the mineral contents of the ground and the accumulated layer of humus.

Reforestation is effected on about 40 per cent of area by seed from standing trees; on about 10 per cent of area by coppicing and on about 50 per cent of area by artificial sowing and planting. The annual yield is strictly sustained. The yield per acre per annum is 74 cubic feet, of which not less than 60 cubic feet is used as fuel. The value of cordwood piled up along forest roads is about \$2.50 per cord. The value of logs cut and hauled to forest roads is about \$11.25 per 1,000 feet board measure. As to the usual method of cutting a crop, about 30 per cent of the yield is made up of stuff obtained from thin-

nings. The remaining 70 per cent consists of mature trees. Wherever regeneration is effected from self-sown seed, the mature trees are gradually removed. Where planting is resorted to, a clean sweep is made of all mature trees over areas aggregating about 25 acres on an average. Large clearings are considered a mistake, as it is difficult to restock them.

With regard to compulsory reforestation the following may be said: Private forests must be planted up within three years after the removal of a mature crop. Exemptions from this rule may be granted, upon application, by the State Forestry Bureau. Waste land planted up by the owner is, once for all, exempted. If a forest owner hesitates to replant his clearings within three years after the cutting of the trees, he is subject to a fine. The forest authorities will replant the clearing at the owners' expense, the owner being allowed the choice of species. Any treatment of forests likely to result in permanent unfitness for the production of timber, is prohibited.

Little damage is done, generally speaking, by forest fires. On the average annually 54 fires are reported, running over 45 acres altogether, and resulting in an annual loss of \$533. In 28 cases out of 272 cases the forests were so badly damaged that it was considered wise to cut the trees and replant the area thus cleared. The principal cause of forest fires is carelessness of smokers. A few only of such fires are annually caused by railroad locomotives, perhaps three annually.

The rank of the forest officer corresponds entirely with the rank of officials in other branches of the public service. The average salary per year of the "Oberforstrat" is \$1,300, of the "Oberforstmeister" \$1,125, of the "Oberforster" \$825, and the office and transportation expenses of the last two named are \$350 and \$200 respectively. No official report is published, either annually or periodically.

PRIVATE FORESTS.

The extent of private forests is as follows: Communal forests, administered by state foresters, 235,000 acres; entailed forests, owned by families, 132,000 acres; ordinary private forests, owned by individuals, 70,000 acres; total, 437,000. All communal forests and all entailed forests are managed on forestry principles, furnishing a sustained yield. The condition of the ordinary private forests is deteriorating, as the productiveness of the soil is abused by pasture, removal of litter and incomplete density of leaf canopy. Communal and entailed forests are worth as much as state forests, namely, about \$100 per acre. The value of private forests owned by individuals is considerably less. The average rate of net income is about $2\frac{1}{2}$ per cent. The total product of the country is well sustained.

Considerable sums are derived in state and communal forests from hunting and fishing leases. The foresters of all grades enforce, *ex-officio*, all fish and game laws. The subaltern foresters, as a general rule, are taken from the army.

The wages of the common laborer average about 50 cents per day. In the mountainous sections wood fuel is cheaper than coal. In the state forests \$24,700 are annually spent for new roads, or for macadamizing old roads. The state oberforster is at the same time the manager of all municipal or village forests lying within his district. The sale of forest produce, however, is done by the mayors of towns and villages. A splendid system of well graded public roads, covered with stone in the Tellford system and maintained at an annual expense of \$270 per mile, facilitates economic forestry to a very high degree.

ITALY.

STATE FORESTS.

It was a peculiar pleasure to receive, as I lately did, from the Ministry of Agriculture at Rome, an account of the forestry of Italy, that beautiful country which dates back thousands of years and whose woods have been sung by Horace and Virgil. The aggregate area of the state forests is 128,960 acres, principally situated in Tuscany—provinces of Florence, Arezzo, Grosseto, Pisa and Leghorn; and Venice—provinces of Belluno, Treviso and Udine. These lands are regarded as inalienable. The prevailing kinds of trees are oak, beech, pine, larch and fir. The total annual expense of administration averages about \$80,000. The annual sale of the raw material from the state forests averages \$150,000. The number of acres annually reforested with trees is 150. The method of reforesting varies according to the different species of trees and the local conditions; but seeding, whether artificially or naturally, is used only for the oak and the beech. For other kinds, such as the fir, pine, larch and chestnut, reforesting is done by planting. Generally good care is taken to maintain a sustained yield. In regard to cutting, the practice is to cut only those trees which have reached fiscal maturity and those that are dead or about to die.

The damage caused by forest fires amounts to about \$80,000 a year. The causes are principally accidental. Only a very small number of forest fires are caused by railway locomotives. The forest service has much importance in the protection of mountainous land and in the control of water. The annual salary of the chief inspector of the forests of the first class is 6,000 lire; that of the chief inspector of forests of the second class, 5,000 lire; that of inspector of forests of first class, 4,000 lire.



Rainy Lake Falls, showing glimpse of the village of International Falls formerly called Koochiching. Photographed September, 1903, for the annual report of the Chief Fire Warden of Minnesota.



Hard wood forest between Bena and Leech Lake River allotted to the Chippewa Indians. Photographed for the Chief Fire Warden's annual report August, 1903.

The Minister of Agriculture generally publishes a detailed report on the administration of the forests every five or six years.

NORWAY.

STATE FORESTS.

The extent of the state and semi-public forests of Norway is 2,587,500 acres. Of these, 837,500 acres are located in the provinces of Tromsø and Finmark; 140,000 in that of Norrland; 285,000 in North Drontheim, and 225,000 acres in South Drontheim and Romsdal, and about 397,500 acres in Hedemarken. The prevailing kind of trees are pine (*pinus sylvestris* L.), spruce (*Abies excelsa* D. C.), and two species of birch. The average estimated value of the forest land is \$2.70 an acre. The annual aggregate expense of administration is about \$108,000, and the annual aggregate revenue varies from \$60,000 to \$67,500. The number of acres annually sown or planted to forest varies from 150 to 175 acres. Reforestation is almost entirely effected by natural seeding from standing trees, and, when artificial culture is employed, by planting trees. The crop of forest production is periodical, and depends partly on the market prices of lumber. The forest administration tries to prevent the yearly average yield exceeding the net increase of the forest. Cutting must in part depend on the demand. Where it does not pay to cut smaller trees, the mature ones are principally cut, while at the same time, as far as possible, diseased and injured trees, as well as such as would hinder in the growth, are removed. Where, on the other hand, trees of smaller size can be profitably sold, small blocks are cut clean in order better to promote new growth.

The law of July 20, 1893, on the preservation of "Protecting Forests" and against the destruction of forests, has special provisions relating to "Protecting Forests," by which are meant forests serving as a protection against snow avalanches, stone slips, alteration of river beds, shifting sand, or as a special protection to other forests or to inhabited country. "Protecting Forests" are also such as bound districts and mountain forests, which, from their situation on the slopes of high mountains or in the neighborhood of the sea, or in the far north, grow so slow that they would die out if neglected. Under "Protecting Forest Lands" are also included bare fields, to be planted in the future to serve as other "protecting forests." The municipal council selects three men, who, after consulting the public forest officer, propose the localities within the district to be considered as "protecting forests." The municipal council has then to fix the boundaries of the forests, and on the proposition of the forest inspector of the district to determine the rules for its management. These regulations must have the sanction of the king to be valid. The municipal council can also make reservations, subject to the king's approval, against the destruction of the forests in general. Such municipal regulations relating to "protecting forests" and forests in general may probably also include compulsory regulations as to planting and sowing of forests already cut down. No other laws relating to forest culture exist in Norway.

The damage caused by fires in the public forests is inconsiderable. Many years there is none; and the damage done to private forests is of small account and unreported. The principal cause or causes of such fires is carelessness of owners, fishermen, cowherds, etc., as well as the burning of heather for cultivation of the land. The law of July 14, 1893, on "Fires in Forest and Fields," with the supplemental law of July 27, 1896, has provisions relating to the prevention and extinction of forest fires.

The central administration of the forests is directly under the department of the interior, without intermediate officers. The service is under the charge of the chief (the director of the forests), and there are 4 forest inspectors, 25 forest officers, 1 forest engineer, 2 assistants, 7 forest planters and 363 forest guards. The yearly salary of the chief (the director) is \$1,450, without additions. The inspector's salary is \$800, increasing up to \$970. The forest officers, \$480, increasing to \$800. All these functionaries have their traveling expenses paid when traveling in the service of the state. The officers and the inspectors hand in every year a report to the director, who publishes a report on forest matters generally every third year. The only forest periodical in Norway at present is the "Tidsskrift for Skovbrug," (Periodical for Forestry), published by the Norwegian Association for Forestry.

PRIVATE FORESTS.

The aggregate extent of private forests is 18,000,000 acres, of which about 276,000 acres are managed on forestry principles. The average value per acre is from \$4.28 to \$5.36, and the average annual rate of net income is from 55 to 60 cents per acre. The cutting undoubtedly exceeds the natural increase of the forests. The supply of wood is consequently decreasing, and the size of the trees decreases. The government purchases annually forests to the amount in value of \$21,440. It has three large and several smaller nurseries. These supply the required number of plants to the public and to private parties. It has also four seed establishments, which supply the public and private demand for tree seeds. It also has two elementary schools of forestry, and it tries through its functionaries to instruct forest owners in rational management of the forests.

PRUSSIA.

STATE FORESTS.

The extent of the state forests of Prussia is 6,955,227 acres. Included in this, however, are 715,637 acres not designed for tree culture. In addition, the extent of forests belonging to municipalities is 2,563,812 acres; belonging to churches, 207,752 acres; belonging to corporations, 555,900 acres; private forests, 10,828,730 acres; making an aggregate extent of 21,111,421 acres in the whole kingdom.

The prevailing kinds of trees in the state forests are Scotch pine, larch, beech, red pine, fir and oak. The value of the land varies so much, rising from a small amount to \$700 per acre, that it is impossible to give an average estimated value. The annual aggregate expense of administration (state forests) is as follows: The office expenses and maintenance, including expense for education in forestry, etc., averaged in the years 1893 to 1897, per annum, \$8,500,000. The annual aggregate revenue in the years 1893 to 1897 amounted to \$17,200,000, being at the net rate of \$1.50 per acre of actual forest. The number of acres sown or planted with forest annually during the years 1893 to 1895 was 44,830.

The foresting of the beech is mostly effected from standing trees, though artificial sowing and planting are also done. The oak is either reforested by seed from standing trees, or artificially through sowing or by planting. The Scotch pine is first cut clean and reforested by sowing or planting, and the red pine the same. Sowing from standing trees is not common. In regard to the continuity of forests products, the forestry department endeavors to obtain the highest possible continuous net income. The usual method of cutting is in blocks clean.

Under the head of compulsory tree planting the following laws are referred to: The Forest Protection Law of

July 6th, 1875; the law of August 4th, 1876, concerning the administration of forests owned by municipalities and public institutions in the provinces of Prussia, Brandenburg, Pomerania, Posen, Silesia and Saxony.

The average annual damage caused by forest fires in the years 1892 to 1896 was as follows: Totally or mostly destroyed, 2,992 acres; only slightly damaged, 117 acres; only the surface destroyed, 522 acres. The average annual number of forest fires in the years 1892 to 1896 was 36, the causes of which were as follows: 12 unknown, 2 railroads, 5 incendiary, 16 caused by carelessness, 1 lightning. During the years 1892 to 1896 the annual average number of forest fires caused by railroad locomotives was 2.

The officers in the forest service are equal in rank to the other high grade officers in the government service. The foresters have clerical rank. The salary of "Oberforster" (district manager) ranges according to length of service from 2,700 to 5,700 marks. Unfavorably situated officers receive an additional amount, the maximum of which is 600 marks annually. In addition there is usually free residence and fuel. The salary of the "Oberforstmeister" (chief inspector) is from 4,200 to 7,200 marks, according to length of service, which is calculated from the time of qualification for the office of "Forstrath" (councillor). The "Oberforstmeister" and "Forstrath" are each allowed an amount not exceeding 2,900 marks for traveling expenses.

PRIVATE FORESTS.

The extent of private forests in Prussia, as above stated, is 10,828,780 acres. About one-half of these forests are managed on forestry principles, and their average value is somewhat less per acre than that of the state forest. On the larger estates the area devoted to forests gradually

increases, while on the smaller estates the forest area probably decreases.

Some of the forests of Prussia are attractive resorts for travelers, and especially pedestrians, who enjoy the excellent roads. Of the celebrated Thuringian chain, which is 70 miles in length by from 8 to 25 miles in breadth, a writer says: "The successive hills melt into each other in gentle undulations, forming a continuous and easily traced comb, and only the northwest slopes are precipitous, and seamed with winding gorges. This mountain range incloses many charming and romantic valleys and glens; the most prominent feature of its picturesque scenery is formed by the fine forests, chiefly of pines and firs, which clothe most of the hills."

Prussia comprises nearly two-thirds of the entire extent of the German Empire, yet its area lacks considerable of being twice that of Minnesota. Thirty-one per cent of its soil is predominantly sandy, and on the whole probably is not as good as that of Minnesota; yet it sustains a population twenty-five times as large as that of Minnesota. This fact might well find a lodgment in the minds of our statesmen, that whereas Prussia annually derives a net revenue of \$1.33 an acre from her 6,000,000 acres of state forest, our state, from about an equal area of land in its borders, adapted to forest, derives no regular net revenue at all.

DUCHY OF SAX-MEININGEN.

The area of state forests is 106,530 acres; of communal forests, 84,460 acres; of private forests, 71,850 acres; miscellaneous, 1,480 acres; in the aggregate, 264,310 acres, being equal to 42.4 per cent of the total area of the state. The state forests comprise 24 units of ad-

ministration, in charge of 24 superior forest officers. The highest functionary in forestry matters is the president of the forestry bureau. The bureau is composed of five forest counsellors, two of whom act as forest inspectors at the same time, each one supervising 12 of the above named 24 forest officers. The annual yield of the state forests is 5,779,669 cubic feet of lumber and fire-wood cut in ripe forests, and 1,288,904 cubic feet of fire-wood and pulp-wood obtained from thinnings. These figures correspond with an annual yield of about 155 feet board measure of lumber plus 0.40 cords of fire-wood per acre per annum. The state forest officers at the same time control the management of the communal and private forests within the state. All grades of forest officers have certain police duties concerning forests, fish and game preservation.

The municipalities owning forests are required to appoint well trained foresters for the management of their forest realties.

SAXONY.

STATE FOREST.

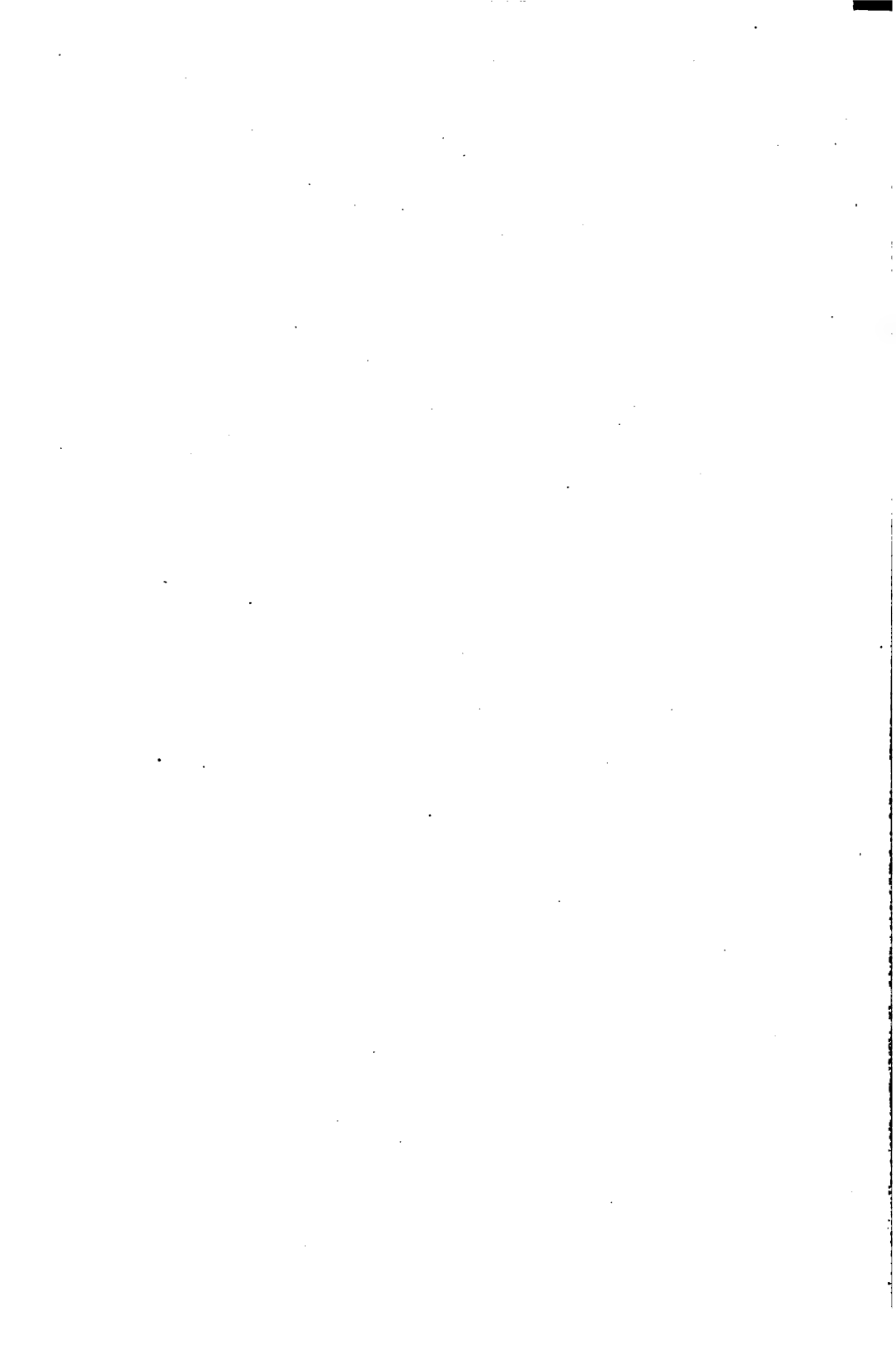
The aggregate area of the state forest is 432,000 acres. The forests are scattered over the Erz mountains themselves and over their outskirts. They are further situated in a few smaller and separate mountain ranges and in the plains. The altitude at which the state forests are found ranges from 100 to 1,200 meters, or from 328.1 feet to 3,937.2 feet, above sea level. The first group of forests, in the Erz mountains, is pretty compact and comprises 200,000 acres. The second group, in the outskirts of the Erz mountains and in some smaller distinct mountain ranges, comprises 136,000 acres; and the third group, in

the plains, comprises 96,000 acres. The soil consists of decomposed granite, granulite, gneis, mica-slate, clay-slate, grauwacke, porphyry, sandstone and some basalt. In the plains there is diluvium and alluvium. Only a very small portion of the forest area might be deemed fit for agricultural use.

The principal tree species are spruce, *picea excelsa* (Link); Scotch pine, *pinus silvestris* (L.); silver fir, *abies pectinata* (D. C.); larch, *larix europæ* (D. C.); roth-buche, *fagus silvatica* (L); oaks, *quercus pedunculata* (Ehrh.), and *qu. sessiliflora* (Sm.); hornbeam, *carpinus betulus* (L.); ash, *fraxinus* (L.); several maples, namely: *acer pseudoplatanus* (L), *A. platanoides* (L); further, several species of elm, *ulmus*; of birch, *betula*; and of linden, *tilia*. The prevailing species is spruce.

The value of the state forests, including timber and soil, aggregates \$76,490,000. Hence the value per acre is \$177. The annual expenses for administration for the year 1896 were \$1,040,000. In the year 1896 the annual gross revenue amounted to \$2,986,000; the annual net revenue to \$1,946,000.

The entire area planted annually varies according to circumstances. On the average it will reach 6,900 acres. Of these 6,900 acres 800 acres are planted up with seeds and 6,100 acres are planted up with plants. About 20 per cent of the above figure 6,900, or 1,380 acres, consist of blanks in plantations previously made where the original planting has failed. Thus it appears that the area planted for the first time after the removal of the old crop is only 5,520 acres. The question whether plants or seeds shall be employed for restocking cleared ground depends on the condition of the soil. As a general rule, seeds are planted only on such areas which do not produce grass and weeds to a large extent and which at the same time are of sufficient fertility and well protected against late frost. The sowing or planting of seeds must





Photograph of the rocky shore of the lake, taken from the shore of the lake.

be done not later than in the second year after the final removal of the former tree crop. Strips about three feet wide or places about six feet square are cultivated with a spade before the seed is thrown on them. Only in rare cases the entire area to be planted with seeds is ploughed and harrowed and the seeds spread over it broadcast. The plants used for planting up a clearing are as a rule two years old or older. The age of the plants selected depends on the condition of the area to be planted aside from depending on the species itself. Spruce, Scotch pine, fir and larch or tamarack, as a general rule, are used two to five years old; beech, oak, ash and maple, as a general rule, are used three to six years old. The plants are raised in nurseries. Only in rare cases they are taken from areas previously planted with seed in the open forest. The number of plants used per acre ranges between 600 and 4,000, according to the species, the size of the plants used and the condition of the area to be planted.

Regeneration from self-sown seed is only used in the case of the beech (*Fagus silvatica*). In all other cases forests are regenerated by means of planting plants or sowing seeds.

There is no law or rule in Saxony for compulsory reforestation after clearings.

There is not much damage done by forest fires. It averages \$300 per year. Forest fires of a larger extent have happened very rarely. As a rule, forest fires are caused by the careless use of matches by tobacco and cigar smokers. Very few fires are caused by sparks from locomotives; on the average perhaps three per year.

The yield or annual cut is fixed by working plans prepared for periods of ten years and renewed after the lapse of such periods. Within these periods the annual yield is almost constant. At the end of a period, however, a new working plan might provide for either a higher or

lesser yield. It is an iron-clad rule that on the whole the cut shall not exceed the increment of the forest.

Trees are cut as low down as possible above the surface of the soil; the instrument used is the saw. The stump and the root are dug out afterwards wherever such work is remunerative, viz., where the wood obtained can be sold at a paying rate. In Saxony regular forest management began with the beginning of the century in a systematic way; consequently the forests now existing are almost even aged and composed of trees of almost even size; hence there is no objection to clearing an entire area of given size, say of two or three acres, at once, removing from it every tree standing on it. In exceptional cases, pieces of forest not entirely mature may be sacrificed with a view of saving others from the dangers threatening from storms and insects.

The average age of maturity in Saxony for conifers (spruce) is eighty to ninety years. However, there are cases in which this rule is not adhered to. The size of trees when fit for the axe depends entirely on the species, on the condition of the locality, the means of transportation, etc. Previous to the final cutting, and beginning with the twenty-fifth year of a piece of forest, and ending at the sixtieth year of the forest, thinnings take place at intervals of about ten years with a view to allow increased light and increased space to the most promising specimens of the growing stock. Specimens growing less vigorously, dying or dead, are removed at the same time wherever it pays.

There is no difference in the rank of the forest officer compared to that of any other state officers employed in the technical branches of the government. The state forestry service is divided into a lower and higher branch. The professional training for the first one is a merely practical training, whilst the latter necessitates scientific preparation of a high class. The requirements with reference

to this scientific preparation are as follows: Graduating from a state gymnasium; six months of practical instruction under a forest officer on one of the state forest ranges; twelve months' study at a university; two and a half years' study at the forest academy at Tharandt, at which two examinations must be passed; three years of practical professional training under a forest officer and at the bureau of forest working plans at Dresden; examination by the state authorities. After this preparation, as soon as there is a vacancy, appointment as government officer might follow, to begin with as assistant of an Oberförster (Superior Forester); then as superior forester, and so on up to the higher ranks of chief of a forest territory or chief of the bureau of forest working plans. The latter officers have the title of "Superior Forest Master." The highest technical authority controlling the local and territorial officers is called "State Forest Master." There are 108 local ranges in Saxony allotted to 11 territorial districts. The former are in charge of a superior forester (Oberförster), the latter in charge of a superior forest master. The central bureau of the entire state forestry service is under the Secretary of Finances.

The salary of a superior forest officer averages \$1,015 (from \$1,150 to \$1,180), to which must be added an allowance of \$566 for traveling expenses, horse keeping and the use of a house free of rental. The salary of the Superior forest master averages \$1,486, ranging from \$1,274 to \$1,698, to which must be added a traveling allowance of \$708 and the use of a house free of charge.

In the case of physical disability the forest officers draw a pension depending on the duration of their state service and on the salary received so far. This pension is at least 30 per cent of the salary. In no case does it amount to over 80 per cent. The latter figure is paid after thirty-nine years or more of state forestry service. At the age

of sixty-five years the state forestry officer is entitled to a pension in case he desires to retire, even if his constitution would enable him to continue in the service.

No annual report of the Saxony forest administration is published.

"Das Tharandter Jahrbuch" is considered the best periodical on forestry.

As further information, it may be stated that the administration of a forest range, by the superior forester under the supervision of the superior forest master, is outlined by "the working plan" which is prepared by the bureau of forest working plans at Dresden, containing prescriptions for a period of ten years. The superior forest officer co-operates in the preparation of this working plan, which has to be submitted to the secretary of finances. The preparation of a working plan is based on a thorough knowledge and a thorough scrutinizing of the conditions of the forest range, which often takes several months. The forest working plan contains a statement showing the areas of the different compartments or units of the forest range; it contains a description of these compartments and maps of the same; all sections of the forests are examined with reference to their increment. All these investigations made, the forests or sections of forests to be cut during the next decade of years are selected and pointed out specifically. Further, there is stated specifically what compartments or sub-compartments are to be thinned out, what areas are to be planted up, and by what means regeneration is to be effected in each single case. Deviations from the prescriptions of a forest working plan must not be made unless authorized by the secretary of finances. Every working plan is controlled by the state forest master in the range itself. Besides, in the midst of the ten years period, or after the lapse of five years, such a control by the highest forest officer of the state takes place, so as to find out whether and in how

far the prescriptions of the working plan have been followed and whether deviations might be advisable.

The sale of the forest produce (timber, fuel, bark, stones, etc.) is done by the superior forest officer with the help of a local state cashier, who is holding an office absolutely independent from the forestry service and is directly subordinate to the secretary of finances. This arrangement makes embezzlements practically impossible. The sale of timber and fuel takes place, after they are cut and piled up, by means of public auction. The cutting and piling of timber and fuel is done by common hands working under a contract. Any planting, on the other hand, is done by day workers, under the supervision of the local rangers, so as to warrant careful work.

PRIVATE FORESTS.

According to a statement made for the year 1893, the total area of the private forests in Saxony is 539,000 acres. All forests owned by municipalities and villages and other corporations, and a considerable fraction of the larger private forests, are managed according to true forestry principles. All administrations of municipal, town and village forests are controlled by the state. The working plans for these forests are prepared by the bureau of forest working plans at Dresden. In these cases, the forest working plan is approved of by the secretary of the interior, and not by the secretary of finances, as would be the case for state forests.

It is impossible to give any data as to the average value per acre of communal and private forests. Neither are data available as to their average annual yield. Generally speaking, the yield of private and communal forests is considered to be lower than from state forests. Wherever there are working plans the cut is steady, and even during the period over which the working plan extends.

Where there are no working plans, the cut depends entirely on the pleasure of the owner.

Small holdings of forests, especially those of the peasantry, are deteriorating. Parts of such forests are changed into fields or meadows; other sections are purchased by the state, communities or wealthy private individuals.

GRAND DUCHY OF SAX-WEIMAR.

The area of state forests is 110,910 acres, of private forests 120,510 acres, in the aggregate 231,420 acres, being equal to 25.6 per cent of the total area of the state. The state forests comprise 37 units of administration, in charge of 37 superior forest officers, trained at the forest academy of Eisenach.

The control of the local forest administration is effected through six forest inspectors, the highest authority in forestry matters being represented by a forestry bureau, attached to the office of the secretary of finances. Forest working plans are prepared and their execution controlled by the "Commission of Forest Working Plans," at Eisenach, the director of the forest academy being at the same time chief of that commission. The annual yield of the state is 5,864,177 cubic feet of lumber and firewood, corresponding with about 125 feet board measure timber plus 0.31 cords firewood per acre per annum.

The main duties of the superior forest officers consist of: Care of the property; maintenance of boundary lines; preventing the acquisition of prescriptive rights to pasture, litter wood, etc., by outsiders, and preventing forest offenses; maintenance of the growing stock of timber; forest utilization and forest regeneration, as prescribed by the working plans; sale of forest produce and control of the book-keeping.

SWEDEN.

STATE FORESTS.

The aggregate extent of the state forests of Sweden in 1895 was 18,080,753 acres. The area of state forests is annually increasing by extensive purchases of private forest. The prevailing kinds of trees are spruce (fir), pine and birch. The estimated value of the state forests is \$4 per acre. The figures in this statement are for the year 1895, in which the aggregate expense of forest administration was \$185,397, and the aggregate revenue was \$1,126,636. The number of acres sown or planted to forest was 10,875. The number of acres damaged by fire was 1,200, and the amount of damage was about \$10,000. Neglected camp fires and carelessness when burning fields for cultivation are the principal causes. Only three fires were caused by railroad locomotives. The state forests are divided into 9 districts and 74 ranges ("revir"). The chief of a district is an officer entitled "Öfverjägästare," with annual salary of \$1,707 and rank corresponding to the rank of major in the army; the chief of a range ("revir") is an officer entitled "Jägästare," with a salary of \$1,200 and rank corresponding to that of captain in the army. Before any one can be appointed as "Jägästare" he must have passed successfully the examinations required after a year's attendance at one of the forest schools, the examinations required during a two years' course at the College of Forestry at Stockholm, and must have practiced forestry a year on a range. Foresters or guards receive a salary of \$160. The state provides dwellings in the vicinity of the forests for officers and foresters. At the head of the forest administration is a director general, with salary of \$2,400, and having rank corresponding to that of a major general in the army;

and a chief of bureau, with salary of \$1,867 and rank corresponding to that of a lieutenant colonel in the army.

There is a continuity of forest product based upon certain plans of cultivation. Reforesting is effected partly by sowing, partly by planting, but principally by seeds from standing trees, assisted by planting. The usual method of harvesting the forest crop is, in the southern part of the country, by cutting in blocks clean; in other parts of the country by cutting trees only down to a certain size fixed by law. The total forest product of the country is sustained, and it is increasing.

PRIVATE FORESTS.

The aggregate extent of private forests is 58,715,135 acres and their average value per acre is estimated at about \$5. About twenty-five per cent of private forests is managed on forestry principles. A royal committee is preparing a project of forest laws to promote re-growth of private forests.

FORESTS OF THE UDDEHOLM COMPANY, SWEDEN.*

The forests of the Uddeholm Stock Company are situated in nine parishes in the province of Vermland and in two parishes of the province of Dalarne. Karlstad, on Lake Wenern, about fifty (English) miles distant, and Gothenberg, about one hundred and eighty miles distant, are the nearest export harbors. Lake Wenern is connected with the Baltic and also the North Sea by the Gotha and Trollhatte (canals). The company owns fifty-six miles of railroad—Nordmark-Klarelfven—with thirteen stations, which transports all sorts of goods, especially iron and lumber, to and between the works. The company owns 400,000 acres of land in Vermland and 25,000

*Information furnished in Swedish by Dr. Fredrik Loven, chief forest master, through Mr. Gust. Jansson, manager of the Munkfors Iron Works.

acres in Dalarne. About 60,000 acres have been acquired within the last ten years. Of the entire area, not exceeding 60,000 acres consist of naked tracts, fields, meadow, also unproductive surface of moss, lake and rocky elevations; while at least about 375,000 acres consist of natural forest-bearing land. Hereof perhaps 15,000 to 18,000 acres are pasture land. Pine comprises 70 per cent of the forest, and spruce 30 per cent of all trees large enough for the saw. The birch is the prevailing species within the pasture, but among the birch conifers are generally found.

The Uddeholm Company's lands lie on both sides of the Klar river along its middle course. The parish of Råmen, in Vermland, and the boundary of Dalarne terminate the extent of the property on the east and the two judicial districts of Fryksdal on the west. About 375,000 acres lie in one body. Only a very little public forest and some belonging to farmers are included therein here and there. The rocky elevations consist of primary rocks, principally granite and gneiss, with interspersed hills of hyperite. West of the Klar river red iron gneiss is almost the prevailing rock, but east of the same river granite prevails, in large part solid, not crystalline, but there are large tracts of primary granite poor in feldspar. On granite, pine prevails to the extent of 75 to 80 per cent, while on gneiss spruce occupies at least 40 per cent of the surface. On the "hyperite" hills spruce of large growth prevails. The soil in the forest is composed partly of the disintegrated rock such as above mentioned and partly of deposits of older or later water courses. Much of the soil is gravelly; much also is sandy. The Klar river within the region of the Uddeholm forest is 400 feet above the sea, and on the east and west sides rise very steep hills which at a distance, generally of a thousand yards, attain a height of from 1,000 to 1,500

feet above the sea; thereafter they take a plateau form, but are very often broken by water courses or bogs. The whole region is thereby in a large degree of that cut or broken character which one can readily obtain an illustration of by ascending one of the principal heights. The highest and only actually barren-topped mountain in the company's forest is Harfjellet, 2,200 feet above the sea. Another, Tönnet mountain, 1,700 feet above the sea, is called a "fjell" (barren-topped or snow-covered mountain), but it is not actually that, for it is partly forest-covered.

Agriculture takes a subordinate place; the land most suitable for cultivation is generally along the banks of the larger streams. About 700 persons occupy small farms as tenants and are obliged to produce certain quantities of charcoal, in general 6,600 bushels each, and in all 4,620,000 bushels. They are also obliged to transport the coal to the works. Besides, there are several hundred forest laborers with smaller premises on which one of two cows and several smaller animals are fed. About 14,000 persons live and gain their livelihood on the company's property.

About 3,000 acres (2,700 to 3,000 "tunnland"; one tunnland being equal to 1.22 acres) are consumed or cut over annually; though it is not easy to say just how much, because clean cutting and selection cutting (cutting only the larger trees) are both practiced. On an average every tunnland (1.22 acres) ought at the end of every rotation period—120 years for pine and 90 years for spruce—yield from 4,000 to 4,500 cubic feet of lumber.

The forest is handled by means of cutting trees that hinder the growth of others or which are themselves defective ("hjelp och rensningsgallringar"), and thinning to admit light ("ljushuggningar"), consisting of two to three careful timber cuttings with an interval of 15 to 20 years,



Rapids in Isabella River, Lake Superior Forest Reserve, July 11, 1924. Photographed for the annual report of the Chief Fire Warden of Minnesota.

which end either by leaving seed trees or in clean cutting. The best stands of pine are finally cut at the age of from 130 to 140 years, and the middling at the age of 120 years, and the poorer at the age of 100 years. The spruce stands in which thinning is much practiced are nevertheless very sensitive to damage from excess of light, wherefore timber cutting must be undertaken with great care and skill, otherwise drought occurs. Spruce is cut at the age of 70 to 100 years, according to its quality. During the past ten years there has been cut yearly 12,000,000 cubic feet of lumber of various sorts, namely, of saw and building timber, 2,000,000 cubic feet; spruce for paper pulp, 850,000 cubic feet; telephone and telegraph poles, 125,000 cubic feet; firewood, 2,275,000 cubic feet; wood for charcoal, 6,600,000 cubic feet; miscellaneous, 150,000 cubic feet. Besides, there was each year brought to the works and consumed stub-wood to the amount of 1,500,000 cubic feet.

Certainly not more than 15, or at the highest 20, per cent of the cut-over area becomes restocked by natural seeding. The cuttings are not so large but what the by-standing trees can in an essential degree contribute to renewal, and, besides, very often 15 to 20 seed trees are left on each 1.22 acre tract. The difficulties which forest culture meets with in this locality are very stony land, spring and summer drought, spring frost, sometimes, as during the previous year, excessive rain, mossy or swampy land and land heavily pastured by cows and sheep. On the other hand, the forest area is not much troubled with heath, strong growth of grass, insects, etc. In regard to sowing, the twigs are burned immediately after the frost is out of the ground, and while the ground is damp. Generally the following year the cleared area is sown with pine and spruce seed. On pine land spruce seed is mixed to about 50 per cent. On land which is suitable

for both, 60 to 70 per cent of spruce seed is used. On pure spruce land 15 to 20 per cent of pine seed is mixed in. On cleared land, to prevent injury from drought, long, narrow seed strips—made by hatchets—are used about a yard apart, not large squares; but when heath or grass growth is to be feared then planting is to be preferred. For hacking of these seed strips are selected places which are suitable for the growth of the seeds and protection of the plants, such as the north side of shading objects,—for example, stumps, windfalls, fixed rocks, etc. The seed is laid on the south corner of the seed strip so that seed and plant will be better shaded. When sown on rocky land it has to be raked and covered by hand. On even ground the seed strips should be made in a direction from east to west, and the seeds not deep, harrowed down along the south border of the strips. On the other hand, on steep descents the seed strips should be laid horizontally, so that the seed, in case of heavy rain, shall not be washed down the hill. During the latest ten years there have been yearly about 2,400 acres sown with from 800 to 900 kilograms of conifer tree seed.

The planting of forest trees takes place on the company's land on a small scale and only where strong growth of grass hinders the growth of young forests. That is usual on good spruce land. There are planted four-year-old transplants from four to five feet apart, so that the number of plants on a tunnland (1.22 acres) varies between 2,250 and 3,500. The average number of trees standing on an acre at the time of cutting is very different, depending on previous cuttings. To more fully answer this question as to old forest on gravelly land which has not been subjected to other cuttings than the thinning of too crowded trees and cuttings of defective trees, the number of trees on two tracts, each of two and a half acres extent, have been counted with the following

result: First tract, average pine land, pure stand of pine; average age, 135 years; average height, 85 feet; diameter measured 5 feet from ground. There were found 8 trees with diameter of 5 inches, 13 of 6 inches, 20 of 7 inches, 27 of 8 inches, 34 of 9 inches, 42 of 10 inches, 44 of 11 inches, 44 of 12 inches, 53 of 13 inches, 40 of 14 inches, 30 of 15 inches, 16 of 16 inches, 11 of 17 inches, 3 of 18 inches, 2 of 19 inches; total, 385 trees, containing 9,178 cubic feet. Second tract, good pine land; young spruce successively grown up; pine of average age of 130 years and average height 85 feet; there were found 3 pines and 37 spruces 5 inches in diameter, 44 pines and 58 spruces 6 inches, 61 pines and 37 spruces 7 inches, 77 pines and 28 spruces 8 inches, 76 pines and 11 spruces 9 inches, 82 pines and 7 spruces 10 inches, 83 pines and 6 spruces 11 inches, 73 pines and 3 spruces 12 inches, 53 pines and 1 spruce 13 inches, 30 pines 14 inches, 14 pines 15 inches, 9 pines 16 inches, 5 pines 17 inches, 1 pine 19 inches, 2 pines 20 inches (in diameter); total, 613 pines and 188 spruces, in all 12,013 cubic feet.

Thus were found about 300 trees left per "tunnland" of about 5,300 cubic feet, which, according to an average age of 133 years, shows a yearly average growth of 40 cubic feet per "tunnland" (1.22 acres). If, on the other hand, timber cutting is done once or twice before the final cutting, as is usual, the number of trees at the last is much less. To prevent forest fires, during very dry weather, strict watch is kept by 30 forest guards and by extra ones, and in addition all of the company's dependents are obliged, when a forest fire breaks out, to send notice to the forest guard or forest manager and assist in extinguishing it. Generally the precautions are effective in preventing such fires. No forest fire worthy of mention has occurred in twenty years.

The company's land has been used for forest more than

100 years. It cannot be said what the net revenue is per acre, as the greater part of the product is used at the works in form of coal or fuel. The average yearly growth per "tunnland" ought to be 40 cubic feet, of which one fourth, or 10 cubic feet, should be saw timber of the net value of 1.50 kronor; 10 cubic feet of building timber, worth 1 kronor; 20 cubic feet of wood, worth 0.70 kronor, or, for the 40 cubic feet, 3.20 kronor (equal to \$0.85).

The income from game is not large. There are shot annually 12 elks, many hares and game birds.

SWITZERLAND.

The Swiss Confederation is composed of twenty-two cantons, which are separate and sovereign states; and while each canton has legislative authority over forests, the Confederation also exercises legislative authority over them in certain regards. Under article 24, of the Federal Constitution of May 29, 1894, the Confederation controls only the forests of the high regions, which are about 65 per cent of the total forest area of Switzerland. It is true that since the popular vote of July 11, 1897, which revises the said article 24, the Confederation has from now on the right of inspection of the forest police of the whole of Switzerland.

The federal law of March 24, 1876, which puts into execution the above-named article 24 of the constitution, was promulgated for the forests of the high regions. By the terms of that law the inspection by the Confederation extends over the entire territory of the cantons of Uri, Schwytz, Unterwald, Glaris, Appenzell, Grisons, Tessin and Valais and over the mountainous parts of the cantonal territories of Zurich, Berne, Luzerne, Zoug, Friburg, St. Gall, Jura and Vaud; but the law does not apply to the forests of the plains of the last mentioned

states, nor to the forests of the cantons of Soleure, Bale, Schaffhouse, Argovia, Thurgovia, Neufchatel and Geneva.

The Confederation is not actually the owner of any forests, but a few of the separate states are owners. The forest domains are part of the national wealth, and comprise 91,587 acres. There are also in the cantons the forests of the municipalities and of the corporations, comprising 1,403,772 acres. Besides there are private forests, comprising 609,855 acres. The total area of forests is therefore 2,105,220 acres, or about 20 per cent of the total area of Switzerland.

Forests are found everywhere in Switzerland. The parts most heavily timbered are the mountain chains of Jura and of the cantons of Schaffhouse, Soleure, Argovie and Neufchatel. Forests are found starting at 200 meters above sea level (in the canton of Tessin) and reach as high as 2,100 meters in the high mountains. In Argovia they even reach 2,300 meters in altitude.

The more common varieties of trees are among the resinous kinds, the opicea, the fir, the larch, the Scotch and mountain pines, the Siberian pine; among the deciduous kinds, the birch and the chestnut tree; this last kind grows especially in the canton of Tessin.

The value of forest land varies greatly and depends on the location, the nature of the soil, thickness of the settlements, the increase of these settlements and on the trade in timber and other products of the forest. The value per hectare ($2\frac{1}{2}$ acres) may range accordingly from 300 francs to 6,000 francs.

In regard to expenses of administration, a distinction must be made between the expenses incurred by the Confederation and those incurred by the cantons. In 1897 the expenses incurred by the Confederation for forest administration amounted to \$56,000.

The following are the net receipts from forests in 1896 as to a few cantons :

Zurich, 180,900 francs, or 91.06 francs per hectare of forest.

Berne, 893,000 francs, or 71 francs per hectare of forest.

Soleure, 33,400 francs, or 44 francs per hectare of forest.

St. Gall, 71,000 francs, or 84.60 francs per hectare of forest.

Argovie, 241,000 francs, or 78.73 francs per hectare of forest.

Vaud, 236,000 francs, or 32 francs per hectare of forest.

The net receipts from town and municipal corporation forests in 1896 were :

Canton of Grisons, 1,200,000 francs, or 10.40 francs per hectare of forest.

Canton of Argovie, 2,378,000 francs, or 70.60 francs per hectare of forest.

On an average about 412 acres of forest have been created annually during the past twenty years, at the expense of the federal treasury.

In order to regenerate the forests, both planting and natural seeding are practiced, as may be most effective.

In the lowest countries, where clean cutting is practiced, planting is resorted to. Where real dangers exist from avalanches, land-sliding, etc., which do not permit complete denudation, and where gardening is required, natural modes of regeneration are generally used, and sowing is seldom done.

Reforestation by the Confederation in high mountain regions costs on an average 400 francs per hectare for 6,000 to 7,000 plants set in their places.

The federal and cantonal legislatures prescribe a sustained production for the forests of the state, of the towns and of the municipal corporations. If, through winds, snow-slidings or otherwise, too much timber has been destroyed, less cutting is done in the following years, in order that as rapidly as possible the forest may regain the number of trees fixed by the management. The forests are operated in various ways, according to localities and ac-

according to the size of timber that is to be grown, viz., high forest, under-growth and coppice.

In accordance with the terms of the federal law, the forest area cannot be reduced. The cleared land must consequently be reforested except in cases where an equal area of land is covered into forest. Furthermore, the cantons as well as the Confederation have the right to compel the creation of protective forests wherever they are needed for public utility.

Forest fires seldom occur. Of those which do occur the principal causes are carelessness in lighting fires in the immediate vicinity of the forests, and lack of care in the woods. It is rare that a forest fire is occasioned by locomotives.

The administration charged to execute the federal forest law is the Federal Inspectorate of Forests, forming a part of the Swiss federal department of the interior. Nearly all the cantons have for their territories a forest administration. In the small states one single technical official is at the head of the service, but in the larger cantons the administration is under the direction of one or more chief forest inspectors or chiefs of the service and of several district foresters or forest inspectors. An inferior personnel instructed for the federal zone in courses lasting two months is attached to this technical personnel, and is organized to execute the work of forest economy.

A few cities or towns with extended and important forests have also a self forest administration, at the head of which is a person of technical forest training. Among them are Zurich, Berne, Lausanne, St. Gall, Winterhues, Friburg, Coire, Soleure, Schaffhouse.

The Chief Federal Inspector of Forests has an annual salary of 8,000 francs and fees of eight francs per day, and eight francs per night, when he has to be absent, for his service; he gets his traveling expenses reimbursed,

his first assistant has a salary of 6,400 francs and is similarly indemnified for his inspection trips.

The three inspectors of the canton of Berne receive each 5,300 francs per annum. They receive extra pay, six francs per day and four francs per night, for all inspections made outside of their city, and their traveling expenses are reimbursed.

The high forester or chief inspector of the canton of St. Gall, who has a salary of 5,000 francs, receives ten francs per day and four francs per night, besides his traveling expenses, when out inspecting.

The Federal Inspectorate of Forests publishes every year a report on its management. The majority of the cantonal inspectors do likewise.

In the matter of taxes, the cantons are sovereign in their own limits. Taxation therefore differs according to the cantonal territory to which it applies. In all these states a tax on the forest is imposed, and in most states that tax is combined with the tax on income. But for one and the same forest only one of these two modes of taxation is generally applied. A few examples will show: In the canton of St. Gall the state has paid to the towns in which it has forests a tax of 1.20 francs per hectare. In Argovie the state pays to the towns where its forests are situated a tax of 2.40 to 3.20 francs per 1,000 francs of forest value. On the other hand, the towns only pay to the state a tax of 40 centimes per 1,000 francs of forest value. The private forest proprietor pays to the state 40 centimes and from 2.40 francs to 3.20 francs to the towns per 1,000 francs of forest value; and in addition thereto he is taxed on the income in the amount of one per cent of the average two per cent of gross declared value of the forest, but neither the state nor the towns pay a tax on the income of their forests.

WURTEMBERG.

Wurtemberg lies west of Bavaria, and is the third German state in point of area, its population being a little over 2,000,000. Its greatest length from north to south is 140 miles, and its greatest breadth is 100 miles. One-third of the Black Forest (so called from the dark foliage of its pines), and which forms a sort of a triangle, lies within Wurtemberg, two-thirds being in Baden. The Black Forest has a total length of 93 miles, and its breadth varies from 13 to 46 miles.

STATE FORESTS.

The aggregate extent of the state forests is 418,904 acres, and they extend over the entire kingdom. Fifty-nine per cent of the forests consists of pine, 20 per cent being pitch pine and 9 per cent white pine. The estimated value of the forest land varies from \$29 to \$58 per acre. The annual aggregate expense of administration of the forest amounts to \$1,183,574. Of this \$364,140 is paid to wood-cutters, \$147,560 is expended on roads, \$90,440 in forest culture, \$259,468 for pay of officials, \$148,468 for forest guards. The revenue was \$2,928,352, yielding a net revenue, after for 1895-1896 deducting all expenditures, of \$1,744,788, or \$3.63 per acre. The number of acres annually sown to forest is 296, and the number of acres planted to forest 6,177.

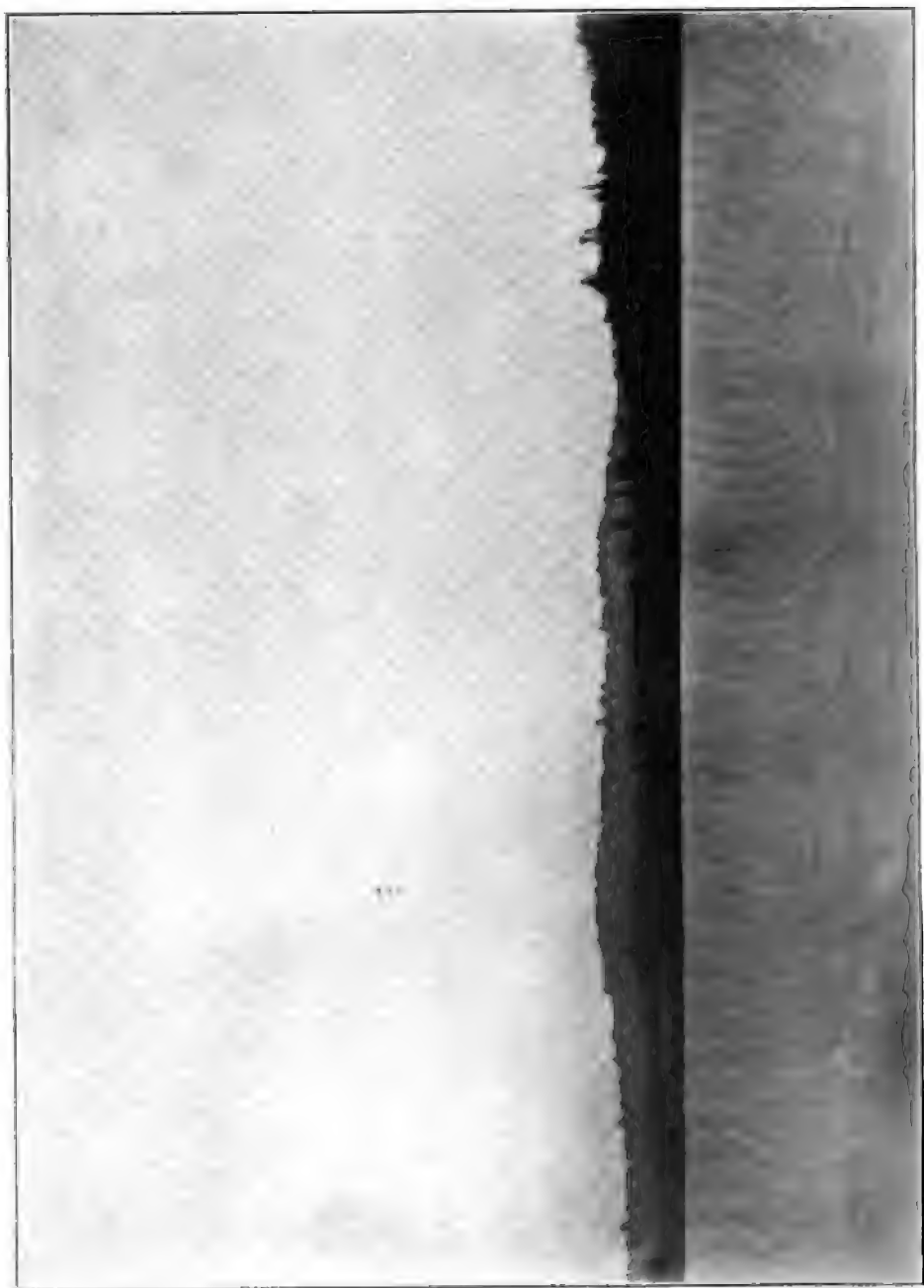
In regard to reforestation, when the natural seeding of the desired kind of wood occurs in proper time the same is used ; otherwise planting or artificial growing takes place. Natural sowing is estimated at about 25 per cent ; artificial renewing amounts to about 75 per cent. The latter is almost exclusively done by planting, whereas sowing in free woodland is very seldom applied. It is a principle to maintain (as far as the division of the age of the plantings

permit) an equal annual cutting. At present the cutting is fixed at 1.94 cubic meters per acre. The cutting is contracted for with laborers living in the neighborhood of the woods. By good management there are at a given plot generally trees of about the same age: If the natural seed falling is intended to be used, the larger trees, either single or in crops, are cut out in a direction against the prevailing winds; the remaining trees are thinned and gradually cut out as the growing young trees may demand. If the natural seed falling is not taken into consideration, the wood crop is cut clean in narrow strips, also in a direction against the prevailing winds, and the cutting of the second and following strips is postponed until the young plantings can dispense with the side protection of the old woods. It is a principle that replanting follows immediately after the cuttings. Moreover, the state buys every year about 400 acres of woodland to increase and round off the forests.

The amount of damage annually caused by forest fires is only \$642.60, and the principal cause of such fires is carelessness and negligence while smoking and lighting fires in or near the forests. In the last ten years, out of 120 forest fires only 8 were caused by sparks from locomotives, and of these only one caused considerable damage (about \$3,570).

In regard to the rank in the forest service, as compared with other branches of the public service, it may be said that the forest officials rank in general equally with those state officials who are graduates of the university. The Department of Forests is directed by one president, four technical and four administrative members and one commander of the forest guards. The salary of the president is \$1,844.50 per year; the salary of the members of the Board of Direction is from \$1,190 to \$1,618. A work entitled "The Forests of Wurtemberg," published by





Lake Superior Forest Reserve looking north on Kibow Lake. Distant highland is the shore of Wigwam Lake. Photographed July 14, 1903.
For the annual report of the Chief Forest Fire Warden of Minnesota.

Rueger, Stuttgart, 1880, gives a fair review of the situation of the forestry of the country. It may here be stated that in respect to net revenue Saxony and Wurtemberg stand at the head of forest administration and forest culture in general.

PRIVATE FORESTS.

The aggregate extent of private forests is 528,794 acres, of which 210,000 acres are administered by technical forest officials; the remainder is also administered in a proper manner. As the permission of the government is required for cutting and replanting of forest lands, and this permission is only given under the condition that an equal area to what has been cut shall be planted, the aggregate area of forest land remains the same throughout the whole country; but portions of it are gradually coming into the possession of the state government.

FREDERICK THE GREAT, THE FATHER OF GERMAN FORESTRY.

Frederick the Great promulgated laws in 1740 and 1754 for regulating the cutting of wood, which previously had been done as everyone pleased, without any regard to replanting. In place of such improvident practice he established rotations of 70 years; that is, he provided that forests should have 70 years in which to mature before being cut, also prescribed methods of thinning so that the young and healthy growth of oak and beech would be better protected. Later instructions were issued in 1764, 1770, 1780, 1783. In addition to this he instituted communal forests under the care of wardens, forbade private owners from every wasteful cutting and placed under the care of the state a portion of the forests in Silisia which previously

had belonged to private parties. Frederick the Great ordered the division of the national forests into compartments or blocks, each of which was to acquire the age of 70 years before being cut. But inasmuch as it was found that 70 years were not sufficient for the proper growth of the trees, each of these main compartments were subdivided into two compartments, so that a period of growth running 140 years was established.

There had been, in more ancient times, laws relating to forests for certain parts of Prussia, the first dating 1547. These related to the right of using the forest and necessity of replanting, more than to general systematic care. One can therefore properly claim that Frederick the Great is the father of the German forests, as it was he who created the existing forestry laws and made them apply to private as well as to state forests.

THE WORKING PLAN.

The "Manual of Forestry" in five volumes, by Dr. William Schlich, principal professor of forestry at the Royal Indian Engineering College, Cooper's Hill, England, and formerly Inspector General of Forests to the Government of India, is the best work on the subject in the English language. Dr. Schlich has kindly given me permission to copy from his third volume an account of the "working plan" as used in forestry, and what follows on that subject is taken from that volume.

Forest working plans regulate, according to time and locality, the management of forests in such a manner that the objects of the industry are as fully as possible realized. The working plan for a protection forest, or a park-like forest, is altogether different from that of a forest which

is managed on economic principles. The latter is the kind with which we have here to do.

The working plan report is a document which gives necessary information and which describes the system of management in such detail as may be required in each case. For forests which are of great value, and which yield high returns, very detailed plans should be drawn up; for forests which give as yet only small returns, simple plans would be indicated.

WORKING PLAN REPORT.

INTRODUCTION.

I.—GENERAL DESCRIPTION.

1. Name and situation of forest; name of proprietor.
2. Boundaries.
3. Area.
4. Configuration of the ground.
5. Rock and general character of the soil.
6. Climate.
7. Legal position of forest, rights and privileges.
8. Surrounding population and its requirements.
9. Markets, lines of export.
10. Prices of the several classes of produce.
11. Cost of extraction and of transport to markets; supply of labor.
12. General description of forest growth.
13. Injuries to which the crop is exposed.
14. Rate of growth.
15. Yield tables, volume tables, form factors, reducing co-efficients, etc., used in the calculation of the volume and increment of the woods.
16. Organization and strength of the forest staff.

II.—DETAILED DESCRIPTION OF COMPARTMENTS.

III.—DIVISION AND ALLOTMENT OF AREAS.

IV.—DESCRIPTION OF THE METHOD OF TREATMENT.

1. The objects of management.
2. Choice of species.
3. Choice of silvicultural system.
4. Determination of the rotation.
5. General lines of treatment.
6. General lines of yield.

V.—SPECIAL WORKING PLANS.

1. Plans of utilization.
 - a. Final cuttings.
 - b. Intermediate cuttings.
 - c. Minor produce.
2. Plan of formation.
3. Plan of other works.
4. Maps illustrating the condition of the forest and the proposed treatment.

VI.—MISCELLANEOUS.

1. Reorganization of the forest staff.
2. Financial forecast.
3. Proposals for the control of the execution of the working plan.
4. Miscellaneous observations.

WORKING PLAN FOR A PORTION OF THE STATE FORESTS OF
THE HERRENWIES RANGE IN THE BLACK FOREST,
GRAND DUCHY OF BADEN.

PERIOD 1884—1893.

WITH THE RESULTS OF THE ACTUAL WORKING.

GENERAL DESCRIPTION.

1. *Area and Boundaries.*

The areas are recorded as follows:

(a) Productive area	1,747 acres
(b) Unproductive area	nil. "
(c) Other areas, including fields, meadows, etc.	2 "

Total area = 1,749 acres

Alterations in the above figures will probably become necessary when a fresh survey is made.

The outer boundaries are in order, but the internal boundaries require rectification.

2. *Locality.*

The forest here in question occupies on the whole the slopes lying between a hill range on the south and the river Schwarzenbach on the north. The highest point of the hill range, the Hoher Ochsenkopf, has an elevation of 3,465 feet above the sea, while the lowest part, near the Schwarzenbach, is only 2,000 feet above the sea, the mean elevation being placed at 2,600 feet.

The slopes, on which the forest is found, are mostly steep, level spots being only found on the summits of the hills, and toward the lower end, where granite and Bunter Sandstein meet.

The area is drained by the Schwarzenbach (a feeder of the Raumünzach) with its two feeders, the Gartenbach and Dobelbach. The first mentioned runs from west to east, and the two latter, more or less, from south-west toward north-east. It follows that the forest in the valley of the Schwarzenbach has generally a north aspect, and in the valleys of the Gartenbach and Dobelbach a northwest aspect on one side, and a southeast aspect on the other side of the streams. All the forest areas (except those situated at the highest elevations and which are of no importance) are protected by intervening ranges against the prevailing winds.

Up to a mean elevation of 2,500 feet, granite is the principal rock, which is sometimes (though rarely) pierced by porphyry. Above the afore-mentioned elevation the granite underlies upper Bunter Sandstein (Vogesen Sandstein), and the latter accordingly prevails in the larger part of the forest area.

The granite is generally rich in orthoclase and oligoclase, and therefore decomposes readily, and furnishes mostly a deep soil rich in mineral elements. The decomposition is facilitated, and the quality of the soil improved, by the remarkably numerous springs which appear between the granite and the Bunter Sandstein. Hard slow decomposing quartzite is of rare occurrence.

The Bunter Sandstein is characterized by rapidly and greatly changing mineral composition, consisting sometimes of readily decomposing rock yielding a deep clay soil, in other cases of hard quartz-gravel, frequently found on the surface in the numerous bolder-drifts. The Bunter Sandstein has numerous rents and fissures in all directions, so that it is rapidly drained, and the disintegration and decomposition are only rarely assisted by springs, which at the best are scanty and intermittent. It follows that the Bunter Sandstein soils, even when formed by the easily decomposed and minerally rich clay sandstone, never equal the best quality of the granite soil; moreover, they change frequently and very suddenly, and without any visible cause, into almost unproductive areas.

On the flat hill tops, layers of fine white sand (produced by the disintegration of the gravelly sandstone) frequently produces an impermeable stratum, preventing the water from percolating, thus causing bogs (or "Gründe") which often extend over considerable areas and are almost unproductive.

The quality of the soil, therefore, ranges between good and unproductive, in the following proportion:

Good and fairly good to medium	= 78 per cent.
Medium to indifferent	= 12 "
Indifferent to unproductive	= 10 "

The climate is rough, and is characterized by long winters with an abundant snowfall, and by rapid changes of temperature; at the same time it is throughout favorable for forest vegetation, especially for conifers.

3. *Species.*

The details will be found in the description of compartments. Generally speaking, the spruce and silver fir are the prevailing trees, the former being more abundant in the middle and upper parts, the latter at the lower elevations. The beech is associated with them locally and in varying proportions. Scotch pine is found in the granite region chiefly upon dry, steep, rocky slopes with a southerly aspect, and in the sandstone region, especially on dry ridges and the top of the mountains, as well as here and there in other localities. The three conifers attain a maximum height of 140 feet, with regular shaped and little tapering stems. Toward the upper limit of the area the height growth diminishes rapidly, dwindling down to 20 or even 15 feet on the high plateaux. Here the mountain pine and the birch are also found. Reproduction is generally good, except at the higher elevations. A marked difference is found between northern and southern slopes, the growth and reproduction being far more vigorous on the former than on the latter.

The silver fir is much exposed to cancer. Windfalls and snow breakage are fairly moderate, while the damage from insect attacks is very small. During the years 1874-83, the following proportion existed between the different classes of fellings:

Cuttings caused by insect attacks	=	1	per cent of total fellings.
" " snow breaks	=	12	" " "
" " windfalls	=	16	" " "
Cancer and other diseases and injury	=	19	" " "
Other cuttings	=	52	" " "
<hr/>			
Total	=	100	" " "

4. *Method of Treatment and Rotation.*

The situation and the species necessitate the area being treated under the high forest system. The quality gradations, as indicated under 2, are so conspicuous locally that it is possible (as well as desirable in order to secure a proper idea of the condition of the forest), to group the growing stock according to its characteristics as produced by the quality of the locality, and according to the method of treatment thereby indicated. The actual basis of this grouping is the yield, and based upon it, the net income or financial result of the management. In this sense the forest may be divided into the following three groups:

a. Areas Subjected to an Intensive Management.—To this group belong all areas which, in virtue of their quality (as indicated mainly by the height growth of the trees on fully stocked areas) are capable of producing large timber; areas on which carefully conducted regeneration fellings will produce natural regeneration within a reasonable period of time, and where the cost of any artificial assistance in regeneration is commensurate with the anticipated returns. As lowest limit of this group a normal increment of 43 cubic feet per year and acre, calculated for a rotation of 120 years, has been fixed. The area thus included in the group amounts to 78 per cent of the whole. It is with this area, and the growing stock standing on it, that the management must more especially reckon, and from which the

largest possible sustained yield must be secured. With a suitable composition of the growing stock and a careful application of silvicultural principles, that object may be obtained under an average rotation of 120 years.

As regards the silvicultural treatment, and especially the regeneration of the woods, two different classes of forest or growing stock (corresponding with two qualities of locality) stand out prominently.

First. Forest of spruce with a strong admixture of silver fir (the latter occasionally predominating) more or less frequently interspersed with beech and more rarely with Scotch pine.

Secondly. Forest in which spruce predominates with a slight admixture of silver fir and here and there of Scotch pine, but devoid of beech.

The first class of forest occurs in the granite area and on those parts of the Bunter Sandstein (clay sandstone), which have deep, easily decomposed soils fit to be classed as good. The characteristic features of this class of forest are the occurrence of beech and deep soils, rarely covered with boulders or debris, lying mostly at the lower elevations; natural regeneration can here be successfully effected in a comparatively short period of time.

The second class of forest occupies the stony slopes of the Bunter Sandstein area, and in exceptional cases the quartzite parts of the granite area. Here the soil is generally covered with loose boulders and rock debris of varying size. These areas are nearly all found at the middle to upper elevations. The conditions described demand the maintenance of an uninterrupted canopy up to the age of maturity, and a careful execution of the regeneration cuttings spread over a prolonged period of time, or else weeds will spring up, which make regeneration very difficult, and at any rate expensive.

On the whole, however, careful management is sure to be successful in securing natural regeneration in all the areas pertaining to this group; for this purpose, as well as for the production of valuable timber, a rotation of 120 years on an average is considered of sufficient length. The length of the regeneration period differs considerably in the different parts, varying on the whole from 30 to 50 years.

b. The second group consists of woods growing on soils, which, even under the most careful management, cannot be expected to produce trees of first or even second quality. The trees here produced are of such limited height growth, that the production of valuable timber is out of the question. The woods are found in the upper, and here and there in the lower part of the Bunter Sandstein area, where the soil is covered with large masses of the debris of gravelly sandstone, which is not easily decomposed, and where the slightest interruption of the canopy overhead is followed by the appearance of a dense growth of bilberry and heather.

Nevertheless, these areas are capable of yielding timber of the inferior classes, as well as firewood, and the returns which may reasonably be expected from them, justify the application of a method of treatment which, while avoiding any interruption in the canopy and all expensive cultural operations, facilitates natural regeneration; in other words the treatment under the selection system by removing all trees which are deteriorating or incapable of increasing in value. It is difficult to fix any definite rotation, but it is estimated that the trees will take about 150 years to reach maturity.

The lowest quality limit for this group has been fixed at 7 cubic feet increment per acre and year, while the upper limit is, as already indicated, 43 cubic feet. The area comprised in this group amounts to 12 per cent of the total area.

c. *The third group* comprises the so-called "Grinden," that is to say the highest parts of the ridges, which are mostly level and have a tendency to bogginess. They are covered by a dense growth of bilberry and heather, and are incapable of producing more than a stunted tree growth, which yields only a scanty quantity of firewood, frequently not covering the price of preparing it; hence financial considerations are entirely out of the question, the areas being protected merely for the sake of preserving some cover on the hill tops. The group comprises all parts which produce an annual increment per acre of 7 cubic feet and under; they amount to 10 per cent of the total area.

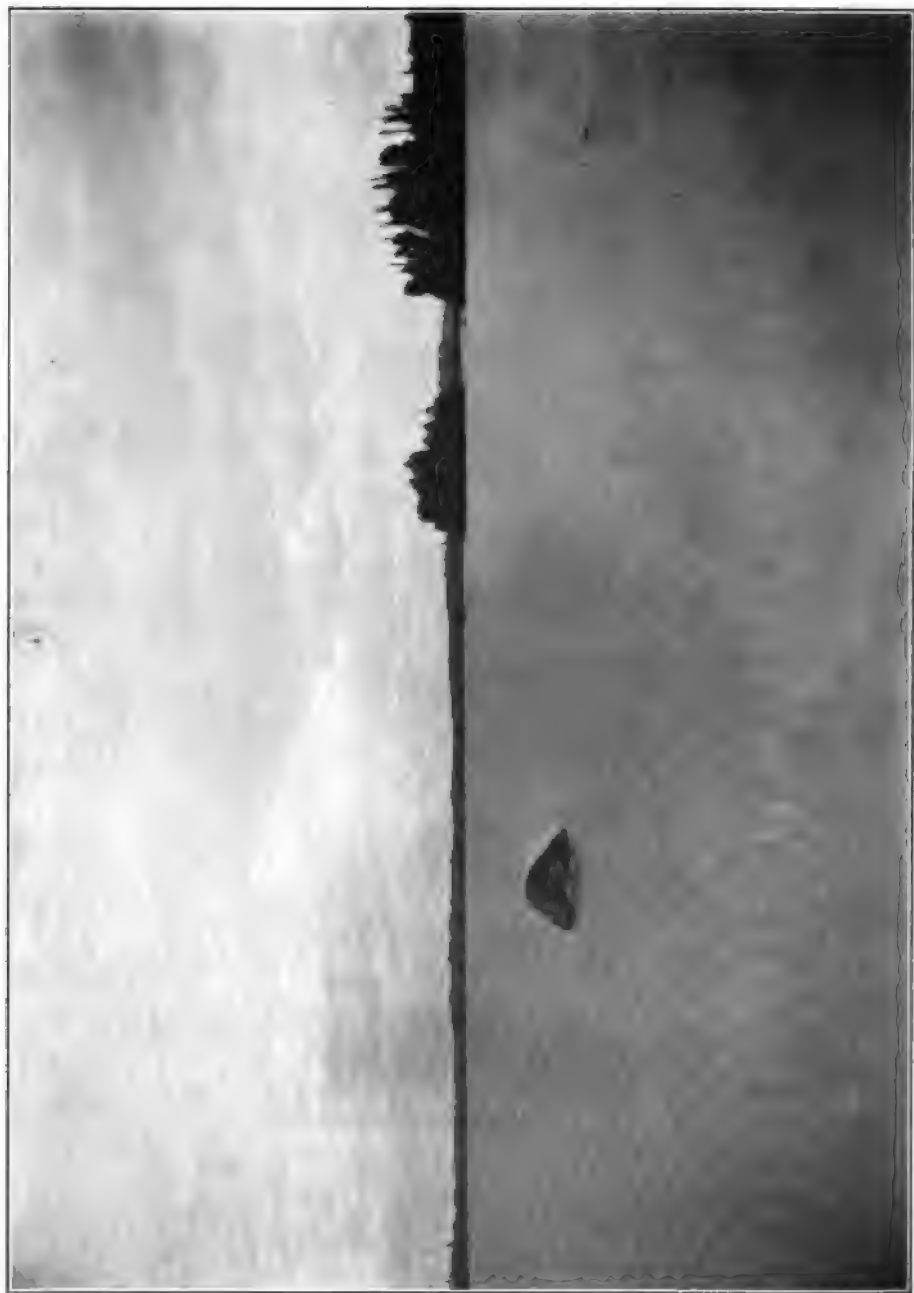
In so far as the management aims at the production of valuable material, and at favorable financial results as regards outlay for artificial regeneration (where natural regeneration has failed), for improvement, tending, etc., only the areas in the first group can be considered. But in the treatment of those forests which pertain to the principal mountain region of the Black Forest, representing a certain drainage area, the task of forestry goes beyond mere financial considerations. It has in fact been recognized that it is necessary to keep areas of this class well wooded for the sake of a proper husbanding of the water supply in the streams. Accepting this further task, the forest administration has endeavored, during the last 50 years, to afforest the poorly stocked and frequently entirely bare areas at the higher elevations of the Bunter Sandstein region. In so far as the cultural operations were confined to the boulder drifts of the Bunter Sandstein, they were moderately successful, but the cultural attempts made in the "Grinden" prior to 1870 turned out failures. Since 1873 the cultural operations in the Grinden present a more hopeful aspect, owing to the experience gained by former failures, and it seems desirable to continue them in the future.

The working plan deals in detail only with the forest area subjected to intensive management, but the group worked under the selection system has also been adequately noticed in the general provisions.

The working plan lays special stress upon the execution of improvement fellings, more particularly the removal of cancerous silver firs. For this purpose the ordinary thinnings are utilized; but over and above these, cancerous trees must also be removed from the old woods, where otherwise no further thinnings would be required. In regeneration fellings the trees to fall first under the axe must be those attacked by cancer. Even then not nearly all cancerous trees can be removed during the next ten years. This fact teaches the management that in future a sharp attack must be made on all cancerous trees at the time of the first and second thinnings, even if a temporary interruption of the canopy should thereby be caused. On the rich deep soils of the granite area, which are almost exclusively concerned in these remarks, even an interruption of the canopy extending over a somewhat lengthy period would not be a misfortune, and preferable to the maintenance of a full canopy consisting to a considerable extent of cancerous trees. The existence of enormous quantities of such trees on the granite area was one of the reasons which led to the yield being fixed at its present rate.

5. *Utilization.*

a. *Yield of Major Produce.*—The actual yield during the last 40 years has been as follows:



Shore of Lake Bellissami, Lake Superior Forest Reserve, July 13, 1903. Photographed for the annual report of the Chief Fire Warden of Minnesota.

Compartment.	YIELD, IN SOLID CUBIC FEET.					
	1844-53.	1854-63.	1864-73.	1874-83.	Total.	Area in Acres.
1. Schwarzenbronn....	218,886	122,869	149,848	79,141	569,189	65
2. Schwarzenberg	811,518	158,778	200,788	158,965	829,984	211
3. Riesenkopf	12,502	47,288	206,242	65,617	881,649	76
4. Mehlskopf.....						84
5. Grünwinkel.....	19,742	124,629	57,428	202,252	404,046	202
6. Dobelbach.....	26,875	42,697	80,195	69,952	189,692	178
7. Hoher Ochsenkopf..						101
8. Kleingartenkopf....	84,256	2,381	1,448	1,024	89,059	76
9. Kleingarten.....	875,687	188,825	256,808	195,578	966,698	882
10. Grossgarten.....	62,544	46,688	26,417	59,118	194,767	175
11. Sachsenbronn.....	84,927	47,788	111,851	106,194	800,255	95
12. Gartenbach	86,311	88,845	494,065	156,412	820,788	172
	1,178,198	814,788	1,584,920	1,094,216	4,622,067	1,747
Average per year.....	117,820	81,478	158,492	109,422	115,552	.....
Average per year and acre.....	67.44	46.64	87.86	62.68	66.14	.....

From the appended statistical table it will be seen that the estimated increment of the next ten years amounts to 1,086,130 cubic feet.

The actual growing stock amounts to 9,488,731 cubic feet

The normal " " 7,892,160 "

The surplus of " " 1,596,571 "

The surplus of growing stock is due to a surplus of woods over 100 years old. With favorable prices for timber, the removal of this surplus in the shortest possible time would be advisable, so as to prevent loss of increment, and take unnecessary capital out of the forest, but as prices run low at present, it appears judicious to keep the greater part of it over for a while.

A consideration of the several compartments showed that the removal of the following material during the next ten years is advisable on sylvicultural grounds:

Final cuttings 1,146,000 cubic feet

Intermediate cuttings 154,000 "

Total 1,300,000 "

As this amount exceeds the expected increment by 213,870 cubic feet, equal to about one-seventh of the surplus of growing stocks, the yield has been fixed at 1,300,000 cubic feet, or annually:—

Final cuttings 114,600 cubic feet

Intermediate cuttings 15,400 "

Total 130,000 "

If in the course of the 10 years prices should rise, there would be no objection to reduce the surplus of growing stock further by additional cuttings.

The disposal of the yield is effected as follows:

1) Free grant to the Roman Catholic Priest at Herrenwies, =	1,500 cubic feet.
" " " School " =	1,000 "
(2) Sale by public auction and occasionally by private sale, =	127,500 "
Total annual disposals	130,000 "

b. Minor Produce.—The principal items are forest pasture and the removal of litter, the utilization of which is permitted to the Herrenwies settlers, as a privilege.

According to government orders the privilege of forest pasture may be exercised only to such extent as the condition of the forest and the requirements of regeneration may permit. The district forest officer indicates from time to time the localities in which the privilege may be exercised. The privilege of removing litter free of charge is exercised under the same conditions. The exercise of these privileges is nowhere injurious, and may be continued during the next ten years.

The grass growing in blanks, on roads and in plantations has hitherto been sold for the benefit of the State, and, under suitable supervision, the practice may be continued.

The removal of building stones, the sale of plants, etc., is insignificant.

6. Division into Compartments.

The contemplated new division into compartments must be postponed until the projected road system has been completed.

DESCRIPTION OF COMPARTMENTS.

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
<i>I. Ochsenköpfe.</i>			
Schwarzenbronn	1	65	Spruce with silver fir, some beech, Scotch pine, larch. About .6 of area 30—50 years old, some trees older. About .4 of area 10—30 years old. Above the road fairly complete stocking; in youngest parts still suffering from frost; below road still some blanks caused by late cutting out of old trees; in the latter part still 120—150 years old spruce and silver fir in the final stage; these show a decreasing increment. Growth on the whole fairly good.
Schwarzenberg	2	211	a = 180 acres; 15—40 years old spruce and silver fir with some Scotch pine and beech; some lately planted, younger, a few up to 60 years old. About 25 acres planted. Where the shelter wood has been removed, stocking generally complete, in the rest still patchy with patches of bilberry intervening. Growth generally between good and fairly good; along Herrenwies meadows partly only fair, the spruce still suffering from frost. In the north-western part, below the road, on the Riesenkopf road, and in the south-east along Dobelbach, on about 37 acres 110—140 years old spruce and silver firs of decreasing increment are standing in the final stage.

DESCRIPTION OF COMPARTMENTS—*Continued.*

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
Riesenkopf.....	3	76	<p><i>b</i> — 81 acres (in three parts), spruce and silver fir with a few beech and Scotch pine, generally 50—75 years old, but some small groups only 30—50 years old; generally well stocked, here and there somewhat thin and patchy. Growth between good and fairly good. On 8 acres on the Dobelbach, 80—90 years old spruce, cover complete and growth good.</p> <p><i>a</i> — 47 acres; 100—130 years old spruce and silver fir, some older; on the whole cover fairly complete; toward compartment Schwarzenberg somewhat thin, but on about 10 acres with a fair young crop of silver fir and spruce up to 15 years old. Growth fairly good, on the higher part inferior. About 5 acres along the road is a windfall area, now stocked with some silver fir and spruce growth.</p> <p><i>b</i> — 24 acres; 9—20 years old spruce (a few older), with some Scotch pine and larch, mostly well stocked, showing good to fairly good growth.</p> <p><i>c</i> — 5 acres; Grinde, in upper part heather covered, with 100 and more years old short and stunted Scotch pine, some spruce and mountain pine. On the whole poorly stocked. Part underplanted with 20—40 years old spruce, which show very poor growth.</p>
Mehlskopf.....	4	84	<p>50—90 years old (and more), mountain pine with some spruce, Scotch pine, birch and mountain ash; toward compartments 8 and 5 cover fairly complete, in the southern and south-western parts interrupted by larger and smaller areas of heather. Growth inferior.</p>
Grünwinkel.....	5	202	<p><i>a</i> — 186 acres; 110—150 years old, some older, spruce and silver fir, some beech with a few Scotch pine. In irregular final and seeding stage, in the southern part cover still fairly complete in strips. On .4 of the area stocked with up to 80 years old silver fir and spruce and a few beech. Growth of old trees still fairly good; on some stony ridges (about 7 acres) middling and inferior; young growth mostly only middling.</p> <p><i>b</i> — 16 acres on the highest part in the south and west, Grinde; heather-ground with 100 and more years old crippled Scotch pine, spruce, some mountain pine and birch; in some parts up to 60 years old advance growth thinly stocked. Here and there traces of plantings, 24 years old spruce.</p>
Dobelbach.....	6	178	<p><i>a</i> — 188 acres; 100—180 years old, some up to 200 years, spruce and silver fir, some Scotch pine; on the whole cover fairly complete; only in the western third along Grünwinkel through windfalls and dry wood cuttings somewhat thin and patchy; in the thin parts as yet little, up to 15 years old, advance growth in single trees. Growth good to fairly good. (Hex found).</p> <p><i>b</i> — 27 acres (consisting of the upper south-eastern portion and a ridge running from it in a north-western direction to the centre of the compartment), 100—180 years old (some older), short-stemmed spruce with some Scotch pine and silver fir forming a thin, often very thin, wood; in parts younger up to 60 years old spruce, or an incomplete miserable under-</p>

DESCRIPTION OF COMPARTMENTS—*Continued.*

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
			<p>growth of 25 years old spruce and Scotch pine (experimental planting). Growth middling to inferior.</p> <p>c = 18 acres (uppermost part on the south) Grinde; heather land with 100 years and more old crippled Scotch pine, some spruce, birch thinly stocked; here and there remnants of 25 years old planted spruce and Scotch pine.</p>
Hoher Ochsen.....	7	101	<p>70 and up to over 100 years old Scotch pine and mountain pine with spruce, some birch, sometimes forming a very thin wood of single trees, sometimes in smaller or larger groups; everywhere intersected by heather places and blanks. Growth inferior, even crippled.</p>
Kleingartenkopf.....	8	76	<p>100—120 years old, in some parts younger, some over 300 years old, spruce with Scotch pine, few silver fir, some mountain pine. In the western third and on the eastern point still fairly well stocked, some groups even well stocked; otherwise the wood is very thin and open. Growth middling to inferior; here and there an incomplete miserable undergrowth of 80—60 and more years old spruce and Scotch pine (planted).</p>
Kleingarten.....	9	862	<p>a = 161 acres; spruce and silver fir, some beech. Mostly 60—80 years old, in strips and single trees up to 100 years old, others only 30—50 years old. In the eastern part are about 60 acres 80—100 years old. Everywhere spruce and silver fir standards up to 150 years old, mostly showing good growth. Almost throughout rather thinly stocked, here and there patchy, in consequence of late final cuttings and removal of cancerous silver firs. Growth mostly good, only toward the southern higher part decreasing.</p> <p>b = 122 acres (in 8 places); spruce and silver fir with some beech, $\frac{15-40}{\text{average} = 80}$ years old, some groups up to 50 years; mostly fully stocked. 120—150 years old (some older) mostly pruned spruce and silver firs in the final stage are standing almost everywhere over the above younger growth. The strip along Dobelbach is finally cleared. Growth good; of the old trees fairly good.</p> <p>c = 79 acres (upper part toward the south), 120—300 years old pruned Scotch pine and spruce, few silver fir and birch, thinly stocked, often open; on the whole poorly undergrown with 20—50 years old spruce (mostly planted), a few silver fir; the latter in some places form, with up to 100 years old spruce, the picture of a selection forest. Soil much covered with heather. Growth middling to bad; rarely fairly good.</p> <p>On 6 acres near compartment Dobelbach on the main path, 100 and more years old spruce, with a few Scotch pine and silver fir, form a thin canopy and show middling growth.</p>
Grossgarten.....	10	175	<p>a = 108 acres; spruce and silver fir 80—110 years old, some up to 150, some beech and a few Scotch pine. Partly fully stocked, but the greater part somewhat thin, in the lower part very thin; and here spruce and silver fir advance growth up to 50 years old in single trees and groups. Growth good to fairly good; in</p>

DESCRIPTION OF COMPARTMENTS—*Continued.*

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
Sachsenbronn.....	11	95 (and 2 acres other areas.)	<p>the upper parts with stones (Halde), partly middling only.</p> <p><i>b</i> = 87 acres. (Ridge through middle of compartment and strip on south, southwest, and northwest.) 90–110, some up to 200 years old, spruce and Scotch pine, some silver fir, in the uppermost part some mountain pine in a thin, patchy, and often very thin wood; most of inferior growth; here and there traces of 80–40 years old spruce plantings.</p> <p><i>c</i> = 80 acres (adjoining compartment Kleingarten). A wood resembling a selection forest, of spruce and silver fir with beech, the trees 80–60 years old prevailing; little quite young. The 100–120 years old and older trees appear single and in groups. Growth good; above the cattle track inferior.</p> <p>100–120 years old (some up to 200 years), spruce and silver fir, also some beech, namely:</p> <p>On 42 acres, final stage, partly pruned, throughout with $\frac{10-80}{20}$ years old (in the western part up to 40 years old), silver fir and spruce young growth; about 26 acres in the position of the seeding stage brought about by windfalls and dry wood cuttings; on 5 acres 80–100 years old, generally complete cover; in the thinner stocked parts is found up to 15 years old silver fir and spruce young growth; on 12 acres (southeastern corner, near compartment Gartenbach) generally canopy complete, here and there with a little advance growth.</p> <p>On 10 acres (in the west), 70–90 years old, some older spruce with silver fir, fairly complete canopy.</p> <p>On 7 acres (western point), 12–40 years old (in groups and single up to 60 years old), mostly irregular young growth of spruce with some silver fir, forming a fairly complete stocking.</p> <p>Growth of old trees good to fairly good, in the pruned portions partly less good; growth of young wood fairly good.</p>
Gartenbach	12	172	<p>110–140 years old spruce, silver fir, some older, some Scotch pine, the latter prevailing in places in the upper part, few beech; in the northern two-thirds in the final stage, partly in seeding stage. In these two-thirds about 85 acres are stocked with young growth of spruce and silver fir pretty completely, in the eastern part very fully; in the southern third still fairly complete cover, but on the western slope, already somewhat thin, as yet little young growth. Growth in northern two-thirds good, in the southern third good to fairly good; in the upper part, in the southeast, only middling.</p> <p>In the middle of the compartment are 3 windfalls and 1 beetle clearing, together 12 acres; of these, 7 acres fairly well stocked with up to 25 years old spruce and silver fir.</p>

TABULAR STATISTICAL REPORT

[illegible]

OF THE HERRENWIES RANGE.

CLASSES.						Volume per acre, cubic feet.	INCREMENT.			
81—100.		Over 100 years.		Total.			Annual, per acre.		Total in 10 years.	
Cubic ft.	Acres	Cubic ft.	Acres	Cubic ft.	Acres		Normal	Real.	Normal.	Real.

43 cubic feet per Acre Annually.

15,892	2	84,250	4	152,910	65	2,852	85	70	55,250	45,500
		118,962	12	697,180	211	8,804	85	75	179,850	158,250
		581,408	37	400,490	71	5,641	70	61	49,700	48,810
		1,006,961	148	1,623,050	186	8,753	85	71	158,100	132,060
		1,522,104	188	1,522,104	188	11,444	100	71	158,000	94,490
359,156	49	540,529	48	1,623,050	288	5,753	100	78	288,000	220,740
494,418	49	595,870	49	568,406	188	6,945	85	85	117,800	117,800
42,370	5	459,103	84	568,406	95	5,952	100	71	95,000	67,450
		1,373,758	124	1,887,178	172	8,005	100	86	172,000	147,920
905,845	106	6,402,845	584	8,989,771	1,854	6,603		76		1,026,960
				7,456,200		5,507	92		1,242,700	
				1,488,571		1,008				
								16		5,740

7 to 43 cubic feet per Acre Annually.

		88,850	27	40,620	27	1,504	80	21	8,100	5,670
		208,418	51	214,018	76	2,816	14	14	10,640	10,640
		108,419	54	119,837	79	1,511	48	29	88,970	22,910
		79,460	37	79,460	37	2,148	21	21	7,770	7,770
		430,147	169	458,480	219	2,071		21		46,980
				862,880		1,657	28		60,480	
				90,580		414				
								7		18,490

cubic feet and under per Acre Annually.

		4,500	5	4,500	5	900	7	7	850	850
				18,900	84	556	7	7	2,980	2,880
		11,800	16	11,800	16	706	7	7	1,120	1,120
		7,400	18	7,400	18	411	7	7	1,260	1,260
		58,400	101	58,400	101	529	7	7	7,070	7,070
		76,600	140	95,500	174	549		7		12,180
				73,080		420		7	12,180	
				22,420		129				

Three Working Sections.

				9,488,781						1,086,180
				7,892,160						1,815,860
				1,506,571						220,230

ANNUAL REPORT OF SPECIAL WORKING PLAN.

COMPARTMENTS.	DESCRIPTION OF CUTTINGS, CULTIVATION, Etc.	CUTTINGS.		Cultivation. Acres.	Draining Ditches. Feet.	Road Construction. Feet.
		Final. Cubic feet.	Inter-mediate Cubic feet.			
1. Schwarzenbronn...	Final cutting in regenerated part.....	84,000	.....	.....	.....	.....
	Filling up blanks with spruce.....	.....	.....	8	.....	.....
	Thinning and cutting of cancerous silver firs....	.....	10,000	.....	.....	.....
	Total.....	84,000	10,000	8	.....	.....
2. Schwarzenberg....	a Thinning of shelter-wood and partial final cutting.....	85,000	.....	.....	.....	.....
	Filling up blanks with spruce and Scotch pine.	.....	.....	10	.....	.....
	a and b Thinning and removal of cancerous trees.....	.....	58,000	.....	.....	.....
	Total.....	85,000	58,000	10	.....	.....
8. Riesenkopf.....	a Seeding cutting, and partly final cutting.....	58,000	.....	.....	.....	.....
	b and c Rest.	.....	.....	.....	.....	.....
	Total.....	58,000	.....	.....	.....	.....
4. Mehliskopf.....	Rest.	.....	.....	.....	.....	.....
5. Grünwinkel.....	a Thinning of shelter-wood, seeding cutting in the fully stocked parts by the removal of cancerous and large trees.....	818,000	.....	.....	.....	.....
	b Rest	.....	.....	.....	.....	.....
	Total.....	818,000	.....	.....	.....	.....
6. Dobelbach.....	a Thinning and removal of cancerous trees.....	19,000	19,000	.....	.....	.....
	b and c Rest.	.....	.....	.....	.....	.....
	Construction of an export road to meet the main road.....	.....	.....	.....	.....	4,900
	Total.....	19,000	19,000	.....	.....	4,900
7. Hoher Ochsenkopf	Rest.	.....	.....	.....	.....	.....
8. Kleingartenkopf..	Rest.	.....	.....	.....	.....	.....

SPECIAL WORKING PLAN—Continued.

COMPARTMENTS.	DESCRIPTION OF CUTTINGS, CULTIVATION, ETC.	CUTTINGS.		Cultivation. Acres.	Draining Ditches. Feet.	Road Construction. Feet.
		Final. Cubic feet.	Inter-mediate Cubic feet.			
9. Kleingarten.....	a Cutting of all old standards and cancerous trees.....	45,000	.....	.....	.....	.....
	Thinning.....	.....	8,000	.....	.....	.....
	b Thinning of shelter-wood and partially final cutting.....	198,000	.....	.....	.....	.....
	Filling up blanks with spruce.....	.....	.....	12	.....	.....
	c Cutting out of old defective trees where young growth exists....	14,000	.....	.....	.....	.....
	Construction of an export road to meet the main road.....	.....	.....	.....	.....	9,500
	Total.....	257,000	8,000	12	.....	9,500
10. Grossgarten	a Thinning and removal of cancerous trees.....	47,000	47,000	.....	.....	.....
	b Rest.....	.....	.....	.....	.....	.....
	c Removal of standards and cancerous trees....	25,000	15,000	.....	.....	.....
	Thinning.....	.....	.....	.....	.....	.....
	Construction of an export road.....	.....	.....	.....	.....	5,000
	Total.....	72,000	62,000	.....	.....	5,000
11. Sachsenbronn	In the regeneration area: thinning of shelter-wood and partially final clearing; in the rest seeding cutting.....	168,000	.....	.....	.....	.....
	Filling up blanks with spruce.....	.....	.....	8	.....	.....
	Construction of an export road.....	.....	.....	.....	.....	8,500
	Total.....	168,000	.....	8	.....	8,500
12. Gartenbach.....	Continuation of regeneration cuttings and removal of cancerous trees.....	195,000	.....	.....	.....	.....
	Thinning in fully stocked parts.....	.....	7,000	.....	.....	.....
	Filling up blanks with spruce and Scotch pine.	.....	.....	8	.....	.....
	Construction of an export road.....	.....	.....	.....	.....	8,000
	Total.....	195,000	7,000	8	.....	8,000

SUMMARY OF THE PROVISIONS OF THE

COMPARTMENT.	PROVISIONS OF WORKING PLAN.					
	Cuttings.			Cultiva- tion. Acres.	Drain- ing. Feet.	Road Con- struction.
	Final. Cubic Feet.	Inter- mediate. Cubic Feet.	Total Cubic Feet.			
1. Schwarzenbronn.....	84,000	10,000	44,000	8	.....	.....
2. Schwarzenberg.....	85,000	58,000	88,000	10	.....	.....
3. Riesenkopf.....	58,000	.....	58,000	.....	.....	.....
4. Mehlskopf.....	.....	.....	.....	.....	.....	.....
5. Grünwinkel.....	818,000	.....	818,000	.....	.....	.....
6. Dobeibach.....	19,000	19,000	88,000	.....	.....	4,900
7. Hoher Ochsenkopf.....	.....	.....	.....	.....	.....	.....
8. Kleingartenkopf.....	.....	.....	.....	.....	.....	.....
9. Kleingarten.....	257,000	8,000	280,000	12	.....	9,500
10. Grossgarten.....	72,000	62,000	134,000	.....	.....	5,000
11. Sachsenbronn.....	168,000	.....	168,000	8	.....	3,500
12. Gartenbach.....	195,000	7,000	202,000	8	.....	3,000
Total.....	1,146,000	154,000	1,800,000	86	.....	25,900

NOTE.—The excess was due to heavy windfalls; it will not derange future



Rapids in Cross River, Lake Superior Forest Reserve, July 15, 1903. Photographed for the annual report of the Chief Fire Warden of Minnesota.

WORKING PLAN AND OF THE EXECUTION.

RESULTS OF ACTUAL WORK DONE.						COMPARISON OF PROPOSED AND EXECUTED CUTTINGS.		Remarks.
Cuttings.			Culti- vation. Acres.	Drain- ing. Feet.	Road Con- struction. Feet.	Cut too much. Cubic Feet.	Cut too little. Cubic Feet.	
Final. Cubic Feet.	Inter- mediate. Cubic Feet.	Total. Cubic Feet.						
88,084	12,549	45,588	4.4	.....	.....	1,588	.....	Excess due to windfalls and snow-break.
54,517	75,000	129,517	5.0	.....	.....	41,517	.....
182,900	.....	132,900	1	.....	.....	79,900	.....	Excess due to windfalls and snow-break.
.....	
177,169	.....	177,169	1	.....	.....	.....	140,881	Held back, on account of ex- tra fellings in other compts.
86,606	68,801	154,907	.....	.....	5,008	116,907	.....
.....	.....	.....	.....	.....	.....	.....	.....	Excess due to windfalls.
842,444	21,685	884,079	8.4	.....	9,679	104,079	.....
95,852	.....	95,852	.....	.....	5,220	.....	88,148	Thinning held over.
111,049	.....	111,049	9	.....	8,691	.....	51,951	
197,660	.....	197,660	.....	.....	2,958	.....	4,840	Held back on account of ex- cess in other compartments
1,231,231	177,485	1,408,716	18.9	.....	23,625	108,716	.....

arrangements, as there is yet a considerable excess of growing stock in the forest.

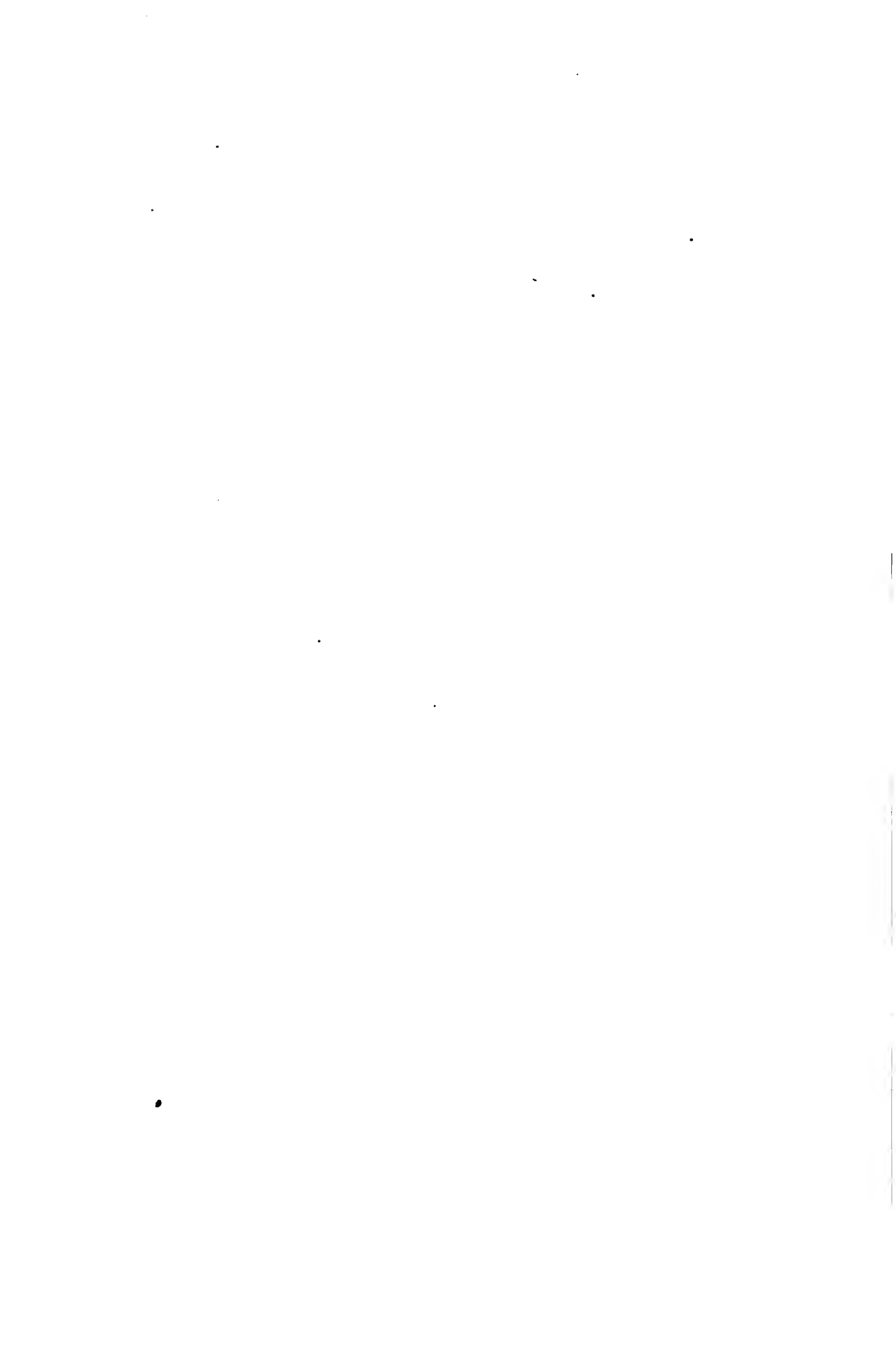
SAMPLE PAGE OF THE DETAILED CONTROL BOOK.

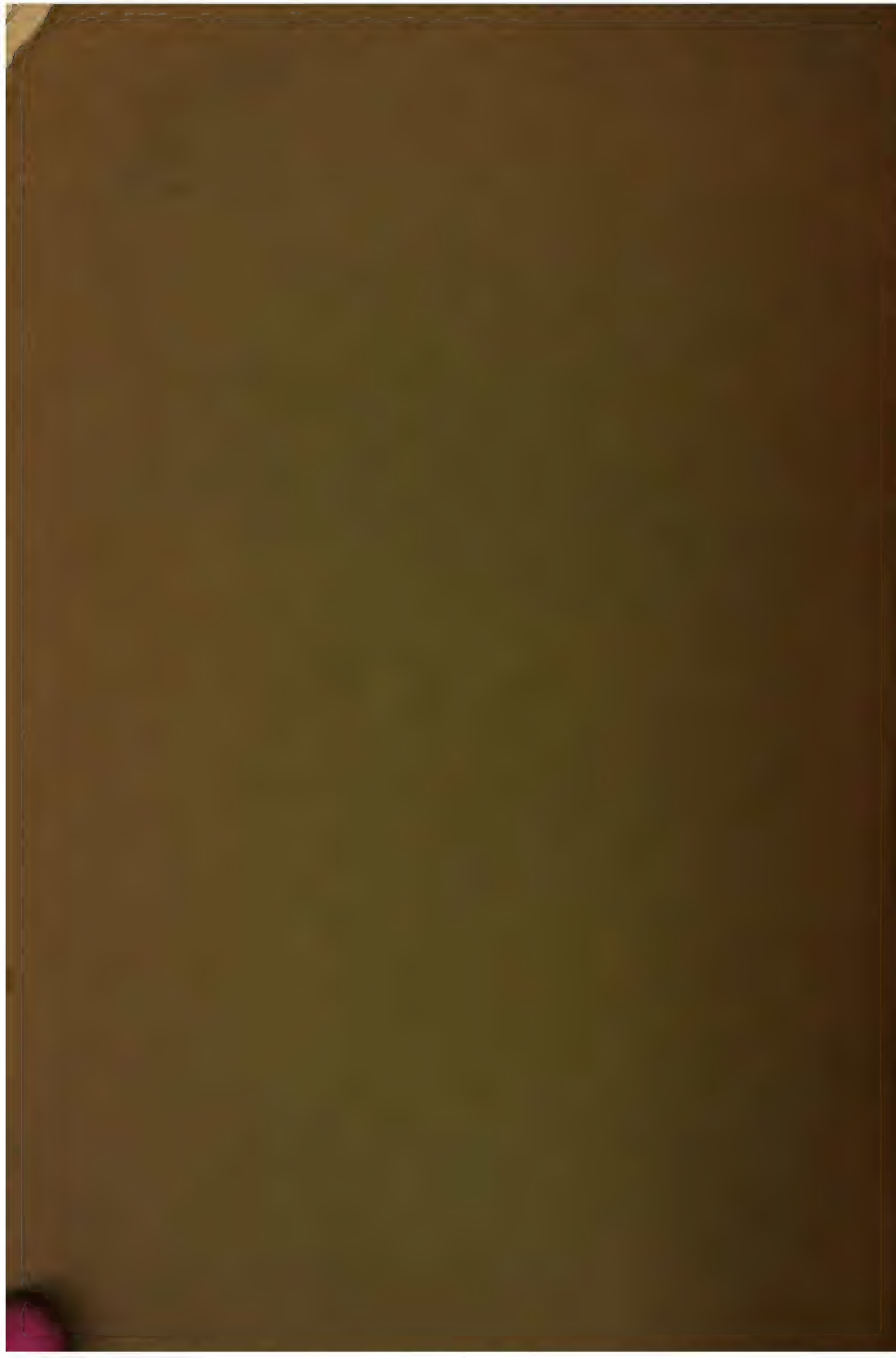
1. *Schwarzenbronn.*

Year.	Description of Cuttings, Cultivation, etc.	CUTTING.		Cultivation. Acres.	Draining Ditches. Feet.	Road Construction. Feet.
		Final Cubic feet.	Inter- mediate Cubic feet.			
<i>Provision of Working Plan.</i>						
	Final cutting in regenerated part..	84,000				
	Filling up blanks with spruce			8		
	Thinning and cutting of cancerous silver firs.....		10,000			
	Total.....	84,000	10,000	8		
<i>Execution.</i>						
1884	Final cutting.....	14,297				
1884	Dry and windfall wood.....	818				
1885	Windfalls.....	665				
1886	Final cutting, thinning.....	6,166	832			
1886	Windfalls.....	547				
1887	Windfalls.....	1,868				
1888	Final cutting, thinning.....	7,759	11,717			
1888	Planting.....			1.7		
1888	Windfalls.....	82				
1889	Dry wood, windfalls.....	649				
1889	Planting.....			2.3		
1890	Windfalls.....	698				
1890	Planting.....			.1		
1891	Planting.....			.2		
1892	Planting.....			.1		
1896	Planting.....			.1		
	Total.....	88,084	12,549	4.4		

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FORESTRY



TENTH ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

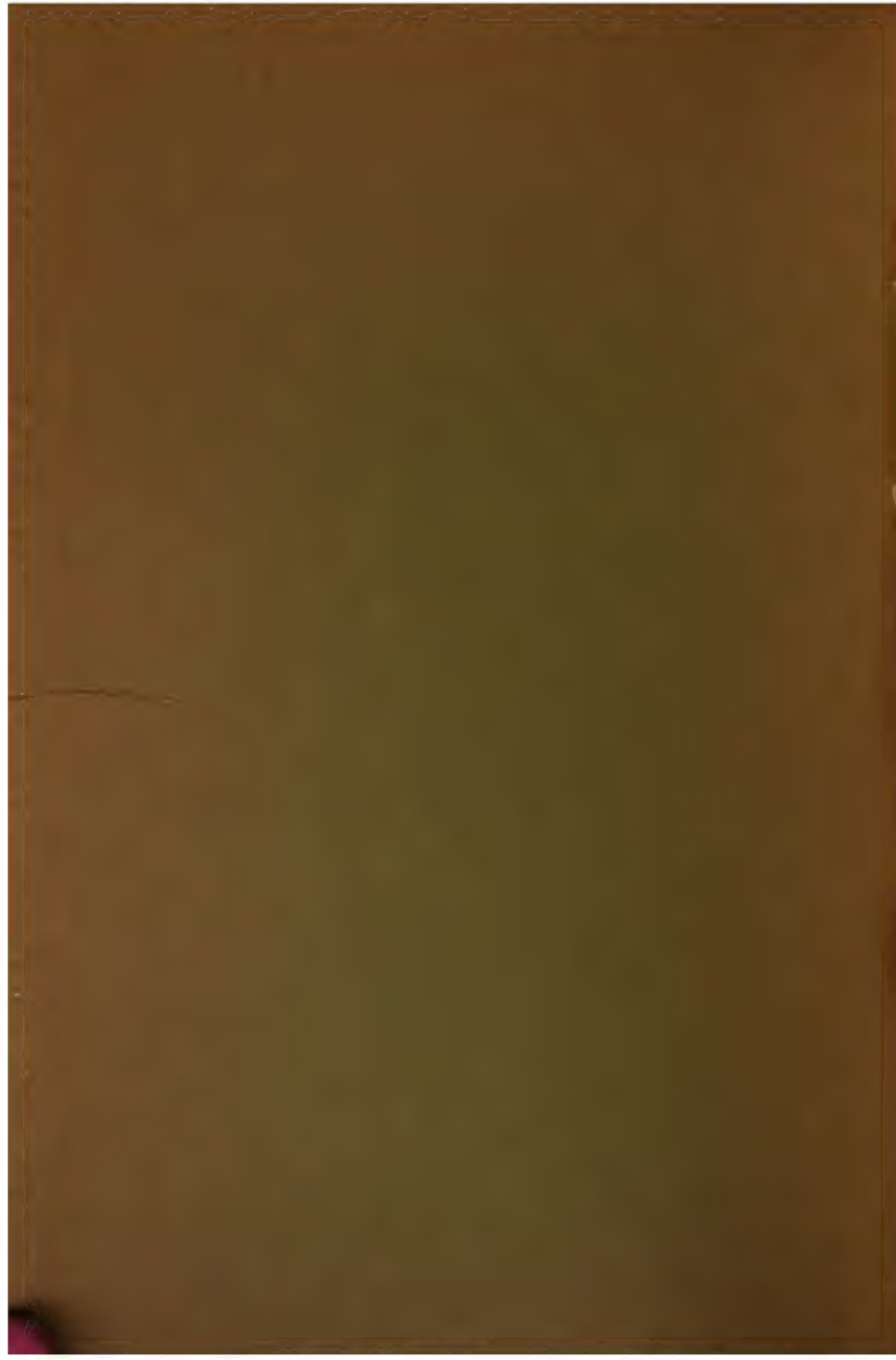
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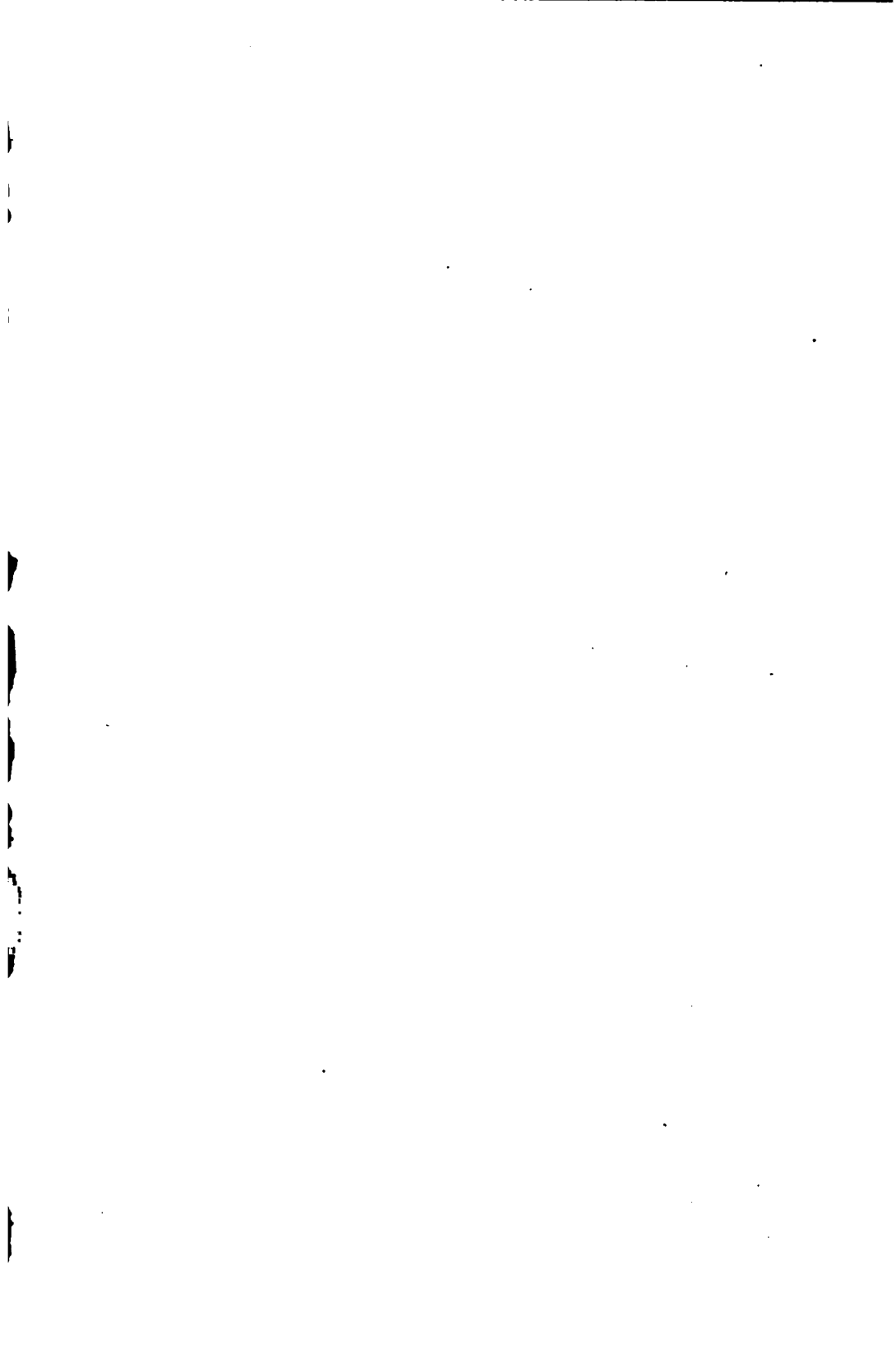
MINNESOTA

UNDER THE ACT OF THE LEGISLATURE ENTITLED
"AN ACT TO PROVIDE FOR THE PRESERVATION OF FORESTS OF THIS STATE AND FOR
THE PREVENTION AND SUPPRESSION OF WOODST AND PRADIE FIRES,"
APPROVED APRIL 18, 1895, AND AS AMENDED BY
THE ACT OF APRIL 21, 1895.

FOR THE YEAR 1904.

ST. PAUL, MINN.
THE PIONEER PRESS MAIL DEPOT.
1905.







Showing a part of nursery containing Norway Spruce Seedlings^a, from seed sown spring of 1904, and covered with brush screens, made under direction of the Minnesota State Forestry Board on the Pillsbury Reserve in Cass County. Photographed October 22, 1904.

FORESTRY



TENTH ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

OF

MINNESOTA

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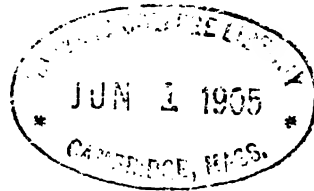
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ST. PAUL, MINN.
THE MINNESOTA PRESS MANUFACTURING CO.

1905

V.5520



The Warden.

STATE OF MINNESOTA,
OFFICE OF CHIEF FIRE WARDEN, }
ST. PAUL, MAY 1, 1905.

Hon. S. G. Iverson, State Auditor and Forest Commissioner:

SIR: As required by section 3 of the Act for the Preservation of Forests, I have the honor to submit, herewith, my annual report for the year 1904.

Very respectfully,

C. C. ANDREWS,

Chief Fire Warden.

TENTH ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

OF MINNESOTA.

As usual, dry weather prevailed in the forest regions in much of April and May, 1904, and some territory had to be patrolled. Also the month of November was very dry and there was not enough snowfall to prevent fires until November 28. According to reports of fire wardens the damage done by forest fires was only \$21,670, and by prairie fires only \$8,305.

A voluntary letter which I received from Mr. L. W. Ayer, of Little Falls, a reliable surveyor and cruiser of more than 30 years' experience in Minnesota, under date of December 12, states: "I believe that danger from forest fires is not one-half, perhaps not one-fourth, what it used to be before the organization of your department, and that no money is better spent than that used in sustaining it." I have heard many similar expressions from disinterested and competent observers.

NEW LEGISLATION.

The legislature of 1905 much improved the law for preventing and extinguishing forest and prairie fires by enacting that the State shall pay for the service of fire wardens and of those who help prevent and extinguish fires, and collect half from the respective counties in which the expense occurs. This secures certainty of pay,

which was not the case in a few counties. The new enactment was an amendment of section 8, and is as follows:

Each fire warden shall be paid for actual service at the rate of two (\$2) dollars per day, and each employee or patrol at the rate of one and fifty one hundredths (\$1.50) dollars per day. Unless directed by the Chief Fire Warden no fire warden shall be paid for more than fifteen (15) and no employee for more than ten (10) days in any one year; but a fire warden shall receive compensation for use of team when plowing for the control of a fire. The compensation authorized by this section shall be paid out of the state treasury on duly verified vouchers approved by the Chief Fire Warden; and one-half ($\frac{1}{2}$) the amount shall be reimbursed to the state by the county in which the expense occurred. The State Auditor shall notify the proper county auditor of the one-half ($\frac{1}{2}$) amount that has become due from his county under the foregoing provisions and such county auditor shall immediately draw and transmit to the State Auditor a warrant on the county treasurer of his county in favor of the state for such amount.

This new provision, as will be seen, throws additional labor upon the Chief Fire Warden.

The legislature also raised the salary of the Chief Fire Warden from \$1,200 to \$1,500 a year. The State is a great body politic, worth eight hundred million dollars, and its servants should be on a respectable footing. It lessens the influence of an office if its pay is relatively so small that the public look down upon it. Besides, it is not sound policy to discriminate against forestry.

APPROPRIATIONS FOR FORESTRY.

A strong appeal was made, but in vain, to the joint sub-Committees of the Senate Finance and House Appropriations Committees to add \$5,000 to the item in the General Appropriation Bill for maintaining the fire warden system, as it appears under the head "For Forest Preservation."

When the system first went into effect in 1895, starting as an experiment and naturally frugal, the item was

\$6,000 for each of the two fiscal years ending July 31, 1896, and July 31, 1897. From some cause the legislature of 1897 reduced the appropriation to \$5,000 a year, at which it has remained ever since. Now, what does this \$5,000 have to cover? First, all of the expense of the central supervising state office; namely, salary of the Chief Fire Warden, clerk hire, printing and binding 4,000 copies of his illustrated annual report and postage for distribution, printing 12,000 cloth notices, the printing of many thousand blanks and circulars, travelling expenses of the Chief Fire Warden; and then one-half of all the expense of the service of fire wardens and those who help prevent and extinguish fires over a territory of 20,000,000 acres! Such are the expenses in an ordinary year which this \$5,000 has to cover. Whether a year is favorable or unfavorable in regard to the prevention of forest and prairie fires we must anyhow go through all the work of taking precautions. It will not do to wait until the danger is upon us.

These facts were stated in my last annual report; they were repeated in the State Auditor's biennial report, and he strongly endorsed my earnest recommendation that this item of \$5,000 should be increased to \$10,000, and we both in person verbally urged it before the Committees. But it was refused. Of course, the "annual" appropriation which the Forest Preservation Act carries for a dry and dangerous season should not be used for ordinary expenses.

How can good service be expected of a department without reasonable means for performing it?

The prevention of forest fires is the principal part of forestry; and those who are interested in the matter, especially those living in the vicinity of the forests, should see that their representatives in the legislature give it favorable attention.

On the 27th of March I informed the Finance and Appropriations Committees that there was a deficiency in this office for the present fiscal year of \$3,410 and requested that amount be made available for the present fiscal year. The sum of \$2,500 was allowed.

As bearing on the forestry situation it will be of interest here to state that the legislature appropriated \$200 to survey and set permanent stakes around the 1,000 acres of Pillsbury reserve and \$250 to reimburse the contingent fund of the Forestry Board for fees paid the United States Land Office accompanying the selection of 20,000 acres of forestry land granted by Congress.

The Forestry Board also asked \$1,200 to be available at once in improving and reforesting the Pillsbury reserve and \$1,200 for the same purpose for each of the next five fiscal years; \$1,600 for a detailed examination, survey and working plan of the 20,000 acres of forestry land granted to the State by Congress, to be available at once, and \$1,800 for each succeeding year for the care, protection and improvement, including roads, of said 20,000 acres; but none of these amounts nor any part of the same were appropriated.

When one remembers that under the direction of our best American statesmen \$127,000 annually is expended for forestry in the Philippines, it would seem that forestry sentiment in this State is as yet but skin deep.



Part of the nursery of coniferous seedlings, covered with lath screens, made by the Minnesota State Forestry Board on the Pillsbury reserve in Cass County. Photographed October 21, 1904.

SUMMARY OF FOREST FIRES, 1904.

COUNTY AND TOWN.	Date.	Acres.	Damage.	Cause.
Beltrami County—				
Blackduck.....	May 28.....	700	\$1,000	Unknown.
Frohn.....	May 3.....	300	50	Unknown.
Frohn.....	May 27.....	150	20	Unknown.
Frohn.....	May 29.....	300	50	Unknown.
Summit.....	May 27.....	620	1,000	Unknown.
Tenstrike.....	May 5.....	100	100	Unknown.
Turtle River.....	May 10-15....	1,200	.....	Unknown.
Benton County—				
Granite Ledge.....	Nov. 28....	80	None	Unknown.
Cass County—				
Byron.....	May 29.....	80	50	Burning meadow.
Cass Lake.....	May 27.....	10	.....	Burning ties.
McKinley.....	May 29.....	3,000	500	Unknown.
Clearwater County—				
Itasca.....	Aug. 26.....	80	None	Unknown.
Leon.....	May 27.....	120	21	Burning meadow.
Cook County—				
Maple Hill.....	May 27.....	40	25	Clearing land.
Tofte.....	May 20 29....	3,000	9,000	Unknown.
Tofte.....	June 16.....	20	300	Unknown.
Crow Wing County—				
Long Lake.....	May 3.....	300	200	Clearing land.
Nokay Lake.....	May 4.....	200	200	Unknown.
Pelegan.....	April 28.....	1,200	1 000	Unknown.
Pelegan.....	May 2.....	300	600	Unknown.
Sibley.....	May 1.....	180	30	Unknown.
Sibley.....	May 16.....	80	50	Lighted cigar.
Hubbard County—				
Crow Wing Lake....	May 3.....	400	75	Clearing land.
Farden.....	June 13.....	75	50	Camp fire.
Hart Lake.....	May 5-6.....	1,600	500	Unknown.
Lake Eunice.....	May 2.....	1,000	50	Unknown.
Itasca County—				
Cingmars.....	June 25.....	300	150	Campers.
Grand Rapids.....	May 26.....	600	300	Smokers.
Nashwauck.....	May 21.....	100	50	Fishermen.
Third River.....	April 27.....	80	None	Unknown.
Trout Lake.....	May 30.....	2	250	Clearing land.
Township 53-22....	May 3.....	700	40	Railroad locomotive.
Township 56-26....	April 30.....	260	50	Burning meadow.
Township 56-26....	May 5.....	140	100	Unknown.
Kanabec County—				
Grass Lake.....	Dec. 7.....	100	40	Burning meadow in Isanti county.
Lake County—				
Township 55-11....	June 16.....	200	75	Unknown.

SUMMARY OF FOREST FIRES, 1904.—*Continued.*

COUNTY AND TOWN.	Date.	Acres.	Damage.	Cause.
Mille Lacs County— South Harbor.....	April 25.....	80	None	Burning grass.
St. Louis County—				
Allen	June 23.....	90	700	Railway locomotive.
Canosia.....	May 5.....	5	40	Clearing land.
Duluth.....	May 21.....	200	25	Fishermen.
Duluth.....	June 13.....	200	1,000	Unknown.
Gnesen	April 29.....	300	1,000	Railroad locomotive
Grand Lake.....	June 9.....	100	None	Camp fire.
Mesaba.....	May 1.....	120	1,000	Clearing land.
Township 55-19.....	May 21.....	4	40	Camp fire.
Township 67-17. ...	July 26.....	4	40	Indian berry pickers.
Todd County—				
Germania.....	Dec. 14.....	600	None	Unknown.
Moran.....	May 2.....	700	300	Clearing land.
Wadena County—				
Huntersville.....	May 18.....	500	50	Unknown.
Huntersville.....	May 27.....	600	150	Unknown.
Turtle Creek.....	May 6.....	1,000	300	Clearing land.

Total acres burned over, 21,920. Damage, \$21,670.

Classification of causes:

Clearing land, 8.
 Railroad locomotives, 3.
 Burning meadows, 4.
 Camp fires, 7.
 Other causes, 4.
 Unknown, 24.

REPORT OF FIRE WARDENS AND OTHERS OF FOREST FIRES FOR 1904.

BELTRAMI COUNTY.

L. J. Romdenne, village president, Blackduck, May 28
 (Telegram):

Fire threatening village. All able-bodied men fighting. Have ordered Bemidji fire department. Advise quick.

Same, June 1:

On May 28th a most serious forest fire (which had been raging for two or three days) to the south and east of this village came upon us in a most threatening manner with a south wind. The excellent service of our fire department of thirty members, together with the help of about 200 citizens, who fought the flames from 8 o'clock A. M. until 6 P. M., saved the day, the fire being under control at about 3 P. M.

J. O. Harris, village president, Tenstrike, May 5:

There are forest fires raging throughout the woods in the vicinity of this village, and we have had men employed for the last week burning around the village to protect same. But our means are about exhausted, so would ask you for an appropriation to assist us in protecting the village from fire.

Same, May 10:

There are 25 or 30 acres of thick young tamarack southwest of the village. It is only a few rods from business buildings in the village. Considering the direction this tract is located from the village, the thickness of the young tamarack upon the same, and butting up to the village as it does, I certainly consider it dangerous. Across the railroad tracks southeast of the village lies a tract of 50 or 60 acres that is practically the same as the tract mentioned above; the location on the north and northeast of the village is about the same size as tract mentioned above; is close to the village and has considerable brush and down dry material on same.

Halvor Hilden, chairman, town of Frohn, May 7:

On the 3rd instant a fire in the central part of the town burned over about 300 acres of cut-over timber land; damage \$50; was extinguished by going ahead and back-

setting where there were roads and openings. Weather had been dry for about a week.

Henry Berg, chairman, town of Summit, June 5:

On the 27th, 28th and 29th of May a fire in the west part of the town burned over 620 acres of slashings, destroyed some cedar, birch and two houses; damage \$1,000. Caused by carelessness along the road by some party unknown. It was extinguished by setting back-fire and clearing. Weather windy and dry for about two weeks.

CASS COUNTY.

E. S. Bruce, lumberman, U. S. Bureau of Forestry.

Cass Lake, May 31 (Telegram):

Forest fires burning in many places along Great Northern railroad on reservation east of here. Have put all my men to fighting it. Fires apparently started from railroad. Assistance will be needed.

A. G. Rutledge, fire warden, Cass Lake, May 27 (Telegram):

Fires raging south and east of here threatening great damage. I shall take men to scene of fire immediately. See report by letter.

Same, May 27:

On Wednesday I patrolled to the west of Cass Lake for four miles, to the village of Farris, and return, going over the ground for a quarter of a mile each side of the track, very thoroughly. I found a few old stumps burning where we had the fight with the fire on Saturday last and extinguished them. I went through T. 145-31, including sections 16, 17, 18 and 13 on the south side of the railroad track and sections 16-9-8-7 and 12 on the north side of the track, which includes the south shore of

Wolf lake. I went over the ground very thoroughly, and found there had been several fires in section 7, running from the railroad. Fire broke out during last night long after I had retired for the night, on the east shore of Pike bay, across the narrows from Cass Lake. I saw the fire at an early hour this morning and investigated. I notified the agent of the Great Northern railway that the fire was on the company's right of way and he sent a few of the section men over to the scene of the fire. I secured a party of seven, besides myself, and we went over and after fighting it with the section men for about five hours we finally got it under control and stopped. Whether the fire was set by some hoboes or a spark from an engine is an open question with me. I believe that it was either started from some neglected burning ties or set afire by the sparks from the engine on the logging train. About ten acres were burned over, being bad in some places.

Same, July 11:

There have been some showers up here, but the underbrush is still in a very dry condition. It seems to dry up here very rapidly. I am making preparations to take in some of the hoboes who are infesting the right of way of the Great Northern railway. On Friday morning last (July 8) I went to Farris, four miles west of here, on the 2 A. M. train, and patrolled the track back to Cass Lake before daylight. There were two camps of hoboes under a bridge. They had a small fire and were sleeping. I made them get up and extinguish the fires and saw that they went their way west off the reservation toward Bemidji.

Same, August 21:

There was a soaking rain on Friday night and Saturday, which has done much to dampen the small stuff in

the woods and lessen the possibilities of fire. We had a small fire on Friday which I extinguished with the assistance of one man, Mr. McClatchie. It was in town 145, range 31, section 7, about two miles and a half west and nearly a mile north of Cass Lake. I cannot imagine how the fire started, but it was blazing considerably when we arrived there.

Same, October 31:

We had a fire a few miles south of Cass Lake Saturday, which was extinguished only after considerable of a fight. I was patrolling on the Great Northern which runs from here to Sauk Centre, when I discovered smoke and investigated. A fire had gotten considerable headway in the timber a few rods from the right of way, about a half mile north of Steamboat lake, in section 17-144-31. I came to town, got a team, secured five men and went back. We used shovels, pails and dippers with good effect, and stopped the fire before it had done much damage. I should judge that two acres were burned over, and some of the pine trees there were badly scorched, but the damage was slight as to what it might have been but for prompt action. The underbrush in the woods is again becoming very dry and the danger from possible fire has been considerably augmented.

ITASCA COUNTY.

J. K. Allen, Little Fork, June 27:

Fire broke out through carelessness or otherwise on section 8, town 67, range 24 (Cingmars), and burned over a portion of sections 8, 9 and 5. Considerable carelessness has been manifested in this part of the country in regard to fires. Those of us that have families and are living in the bush do not like to see fires of this dimension.

E. F. Cingmars, chairman, town of Cingmars, Little Fork, August 3:

The weather is quite dry here at present, which is not unusual at this time of the year. I made a trip last week through one section of the township and found where a fire had burned over a small area and was still smouldering, but there was no danger of it spreading. Owing to the large slashings made in our township by lumber companies in winter, I believe these sections should be patrolled at frequent intervals in the dry season and every precaution taken to prevent a disastrous fire.

A. J. McGuire, Superintendent Experiment Farm, Grand Rapids, June 29:

I took the work upon myself to trace the forest fire of May 25 and found that it was a fire that had burned northwest of here a number of miles and had been burning over a week before it reached here. I went back to where I first saw the smoke the day of the fire, and from there back two or three miles, all of which was burned over. I then met a man who was down from the mine region 12 miles north of here, and he told me it was burned over all the way there and beyond, so I felt there was no use in going farther. I inquired of different parties and was told that the forests had been burning about the mines for some time. I am satisfied that the fire that burned through here was the same one. Going over the ground, I found that the fire had entered our woods in two different places some distance apart, which indicates that the fire was much wider when it reached here than I had supposed. I also find that the young forest is in much better condition than it appeared after the fire. Over three-fourths of the trees have only the lower half of their branches burned, the top being green. From my second estimate I would put less than a third or even a fourth of the trees dead.

Henry Webster, Grand Rapids, July 18:

In regard to the setting of those fires I cannot give you any definite information. There are some dwelling houses about a half mile out of town, east of Crystal Lake. The fire came down from the south, giving the people a hard fight to save their buildings. They told me they did not know who set the fire or where it started, only that it was south of them in a clearing. The fire at the north was set close to the road, about three quarters of a mile from the bridge. A boy who had been hauling wood from that part of the country said he saw two lumber jacks sitting by the road smoking as he went by on his way to town with a load of wood. When he came back the same day in the afternoon the whole country was in a blaze, as everything was very dry at that time.

Thos. M. Daigle, chairman, town of Third River,
April 29:

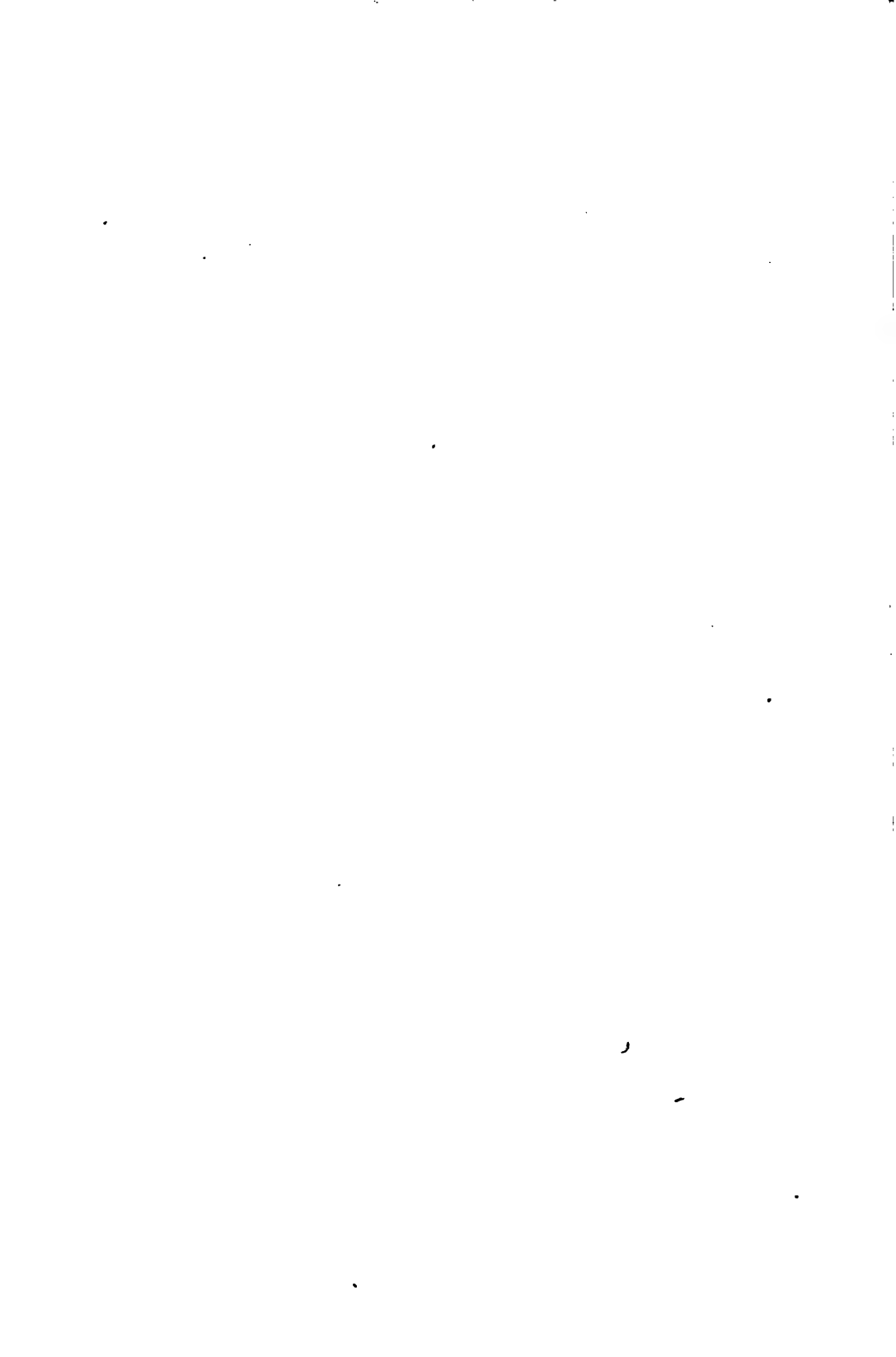
On the 27th instant a fire on section 26 burned over 80 acres, but did no damage. It was extinguished by back-firing and the use of wet sacks. Weather dry.

Ole Hanson, chairman, town of Trout Lake, May 30:

A fire on this date burned over about 150 acres and destroyed 25,000 feet of white pine; damage \$250. It was caused by clearing land. The fire was in two places in one day. It was extinguished by cutting lines, digging trenches and back-firing. Weather dry and windy for about two weeks.

Frank Voigt, Grand Rapids, May 2:

April 30th a fire in township 56, range 26, burned over 260 acres of meadow brush and destroyed light pine timber; damage \$50. It was extinguished by hauling water with a team, back-firing and wet sacks. Weather dry for nine days. Some wind from southeast.





General view of nursery of coniferous seedlings started by the Minnesota State Forestry Board in 1903, on the forest reserve in Chama County, donated to the State of Minnesota by the late Ex. Gov. John S. Pillsbury. Photographed October 22, 1904.

Same, May 11:

On the 5th of May a forest fire burned over 140 acres of light timber. Destroyed poplar and small pine timber; damage about \$100. Extinguished by hauling water and throwing water with pails. A light rain came up and helped extinguish the fire. Weather dry and some wind from southwest.

T. L. Duncan, Ripple, June 13:

(En route from Deer River to International Falls.) There have been no fires along the route. At Ripple yesterday the people burned over some slash without damage to avoid such in future.

KANABEC COUNTY.

J. W. Anderson, chairman, town of Grass Lake, December 30:

On the 7th of this month a fire, which originated in Isanti county, burned over 100 acres of swamp on section 1 and destroyed 9 tons of hay; damage \$40. Weather windy; dry for about three weeks.

LAKE COUNTY.

E. E. Price, postmaster, Marcy, June 16:

Forest fire pretty bad north of Highland for the last two or three days. I have notified men at camps north of here to check it if possible. Fires are pretty bad on all sides of us.

Thos. Owens, superintendent, Two Harbors, June 18:

The fires which Mr. Price refers to did not originate anywhere near the tracks, and, as I was up over the line, I should judge they were at least six to eight miles back from the tracks. From the present outlook we are having very few fires up here. and it would seem to me there

would be comparatively little loss from this cause this year.

ST. LOUIS COUNTY.

E. B. Engren, chairman, town of Canosia, May 30:

On the 29th instant on section 33 a fire caused by clearing land burned over 5 acres and destroyed 20 cords of wood; damage \$40. It was extinguished by throwing dirt and water on it. Weather dry and windy.

Henry Kirk, chairman, town of Duluth, May 28:

May 21st, a fire, supposed to have been set by fishermen on Sucker river, burned over 200 acres of brush and light timber; damage \$25. Weather a little dry and some wind. It was put out by a light shower that night and a heavy shower the 22nd.

Same, September 5:

On the 13th and 15th of June a fire which originated on section 35 burned over 200 acres and destroyed hardwood; damage \$1,000. It went out when it got to the edge of cutting. Weather very dry and windy.

Martin Kuasigroch, chairman, town of Gnesen, May 8:

April 29th a fire which originated on section 21 by sparks from an engine burned a railroad bridge; damage \$1,000. The weather was windy and dry.

John Peterson, chairman, town of Grand Lake, October 8:

On the 9th of June a forest fire burned over 100 acres, some slashings and some timber. Did no damage because the timber would be cut this winter. Supposed to have been set by fishermen. Weather dry and windy.

June 18th there was a fire on section 17 which burned about 20 acres before it was stopped. It threatened sev-

eral farmers who helped to stop the same, but did not ask for pay. Weather dry and windy.

Chas. Lauren, Zim, May 26:

May 22nd a fire in township 55, range 19, burned over 4 acres of cedar and tamarack, damage \$40. It was extinguished by cutting down and carrying away dry bushes. The next day there was heavy rain. Weather had been dry and windy for four days.

Chas. Heise, fire warden, Tower, June 30:

On the 23rd of June a fire in the northern part of the town of Allen burned over 90 acres of light timber and destroyed about 700 acres of hardwood and tamarack. It was caused by some one setting fire or by a locomotive. It was extinguished with the help of three persons by back-firing and ditching. Weather very windy; had not rained for about two weeks previous.

T. L. Duncan (Cruiser for the State), Tower, July 29:

On the 26th of this month, while going up the Vermillion river in a boat, I found fire burning on the west side about the center of section 1, township 67, range 17. The fire was working north in the dry pine needles and moss covering dry, rocky slope. I put this out by stamping and beating, throwing on flat rocks and wet moss and by pulling up the dry moss in the course of the fire. No great damage was done, although about four acres had been burned over, small jack pines and red pines were destroyed and larger trees burned at the base. The heavy duff on the rocks was burned off, leaving it bare. Cause of fire unknown. Indians have been picking berries and camping in this place and may have left a camp-fire unextinguished. There appears to be no regular white inhabitants nearer than Harding, on the south side

of Crane lake, between three to three and one-half miles distant.

TODD COUNTY.

W. S. Brown, chairman, town of Germania, December 19:

On the 14th of December a fire which originated on section 36 burned over a part of four sections, but did no damage; would have destroyed 35 tons of hay if it had not been stopped with the help of eight persons back-firing and beating it. Weather dry and windy for about two months.

John Japp, chairman, town of Turtle Creek, May 10:

Last week there was a brush fire in our town which burned over about three sections. It did no damage except to destroy a lot of young second growth timber.

WADENA COUNTY.

Gust Wegner, fire warden, Huntersville, June 14:

May 18 a fire burned over 500 acres of mostly light timber; damage \$50. The fire was under control in eight hours with the help of four persons. The weather was dry with light wind.

J. C. Holtorf, chairman, town of Huntersville, June 11:

On the 27th of May a forest fire burned over 600 acres of light timber and destroyed only down timber; damage \$150. It was extinguished by team and plowing, wet sacks and water. Weather had been dry for about two weeks and some wind was blowing the day of the fire.

SUMMARY OF PRAIRIE FIRES, 1904.

COUNTY AND TOWN.	Date.	Acres.	Damage.	Cause.
Cottonwood County—				
Selma	Nov. 6.....	240	\$130	Burning stubble.
Kittson County—				
Arveson.....	Nov. 11.....	1,000	100	Unknown.
Clow	Nov. 17.....	2,000	130	Unknown.
Deerwood	Nov. 11.....	1,280	75	Railroad locomotive.
Pelan	Nov. 11-12....	4,000	100	Railroad locomotive.
Percy.....	May 1.....	200	None	Unknown.
Percy.....	Nov. 22.....	800	30	Unknown.
St. Joseph.....	Nov. 11.....	200	60	Indian Campers.
Marshall County—				
Comstock	Nov. 18.....	500	500	Hunters.
East Valley	Nov. 16.....	2,500	210	Unknown.
Eckvoll	Oct. 29.....	160	25	Burning fire break.
Esplee.....	Nov. 2.....	4,000	200	Burning break.
Excel.....	Nov. 16.....	900	None	Unknown.
Grand Plain.....	Nov. 5.....	500	100	Burning fire break.
Grand Plain.....	Nov. 16.....	400	160	Unknown.
Moose River.....	Nov. 10-11....	1,500	100	Clearing land.
Spruce Valley.....	Oct. 29.....	100	80	Unknown.
Viking.....	Oct. 6.....	2,000	Very little	From adjoining town
West Valley.....	Nov. 19.....	200	165	Burning meadow.
Norman County—				
Green Meadow.....	May 17.....	600	30	Clearing land.
Polk County—				
Badger	Nov. 12.....	2,000	400	Unknown.
Belgium.....	Nov. 13.....	4,000	200	Unknown.
Helgeland.....	Oct. 6.....	1,000	50	From Red Lake Co.
Onstad.....	Sept. 24.....	800	500	Railroad locomotive.
Vineland	Nov. 21.....	250	352	Railroad locomotive.
Red Lake County—				
Bray	Oct. 6.....	160	75	Burning break.
Bray	Nov. 11.....	5,000	Slight	Unknown.
Numedal.....	Nov. 14.....	3,000	None	Unknown.
Poplar River.....	Nov. 12.....	1,200	20	Unknown.
Terrebonne.....	July 20.....	70	600	Unknown.
Roseau County—				
Barnett.....	Nov. 2.....	600	63	Burning break.
Deiter.....	Nov. 21.....	1,000	1,800	Unknown.
Dewey	Sept. 30.....	800	300	Unknown.
Pohlitz	Nov. 22.....	3,000	1,000	Burning break.
Stevens County—				
Everglade.....	Nov. 2.....	1,200	650	Burning stubble.

Total acres burned over, 47,260. Damage, \$8,305.

Classification of causes:

- Burning fire breaks, 6.
 - Railroad locomotives, 4.
 - Burning stubble, 2.
 - Other causes, 7.
 - Unknown, 16.
-

REPORT OF FIRE WARDENS AND OTHERS OF PRAIRIE
FIRES FOR 1904.

COTTONWOOD COUNTY.

Gust. Bergstrom, chairman, town of Selma, November 9:

On the 6th of November a prairie fire burned over 240 acres and destroyed 13 stacks of hay; damage \$130. It was extinguished by plowing and whipping with wet sacks. The weather has been dry for 25 days.

KITTSOON COUNTY.

Erick Erickson, chairman, town of Arveson, November 22:

On the 11th instant a prairie fire which originated on section 24 burned over 1,000 acres. Weather dry and windy.

Richard Sylvester, chairman, town of Clow, November 18:

On the night of the 17th a fire which originated on section 20 burned over 2,000 acres of prairie and meadow. Destroyed 40 tons of hay; damage \$120. The fire burned up to plowed land. The wind was so strong it carried the fire as fast as a horse could travel, about ten miles per hour. Weather dry and windy about two months.

R. Bothum, chairman, town of Deerwood, November 15:

On the 11th instant a fire which originated on section 24 caused by a railroad locomotive burned over about 1,280 acres and destroyed haystacks to the value of \$75. The fire went on into the town of Arveson. Weather was dry and windy.

C. E. Kelso, chairman, town of Pelan, November 15:

On the 11th-12th instant a prairie and brush fire which destroyed hay to the value of \$100 burned over half the town. It came from the town west of this. It was caused by sparks from a locomotive. It was extinguished with the help of 25 persons with water and wet sacks. Weather dry and windy for a month.

B. Nelson, chairman, town of Percy, November 28:

On the 22nd instant at noon a fire burned over 800 acres of meadow and brush and destroyed ten tons of hay to the value of \$30. It was extinguished by whipping with wet sacks. Weather windy and dry all fall.

John Zalewski, chairman, town of St. George, November 12:

On the 16th instant a fire originating on section 21, supposed to have been set by hunters, burned over 200 acres of swamp and destroyed 20 tons of hay; damage \$60. It was extinguished by using wet sacks. Weather dry and windy and had been dry for three weeks.

MARSHALL COUNTY.

Harry Adams, chairman, town of Comstock, November 19:

On the 18th instant a fire supposed to have been set by hunters on section 16 burned over 500 acres and destroyed two small stacks of hay and about 500 poplars of pole

size; was extinguished by whipping it with wet sacks. Weather dry.

Ole J. Luske, chairman, town of East Valley, November 19:

On the 16th of November a fire burned over 2,500 acres of prairie and meadow. Destroyed about 70 tons of hay of the value of \$210. It originated on section 28, being mostly vacant land. Weather dry and windy and had been dry for three weeks.

I. P. Johnson, chairman, town of Eckvoll, November 5:

The 29th of October a fire which originated on section 7 in the town east of this burned over 160 acres and destroyed 10 tons of hay worth \$251. Was extinguished by four persons with wet sacks. Weather dry and windy.

L. J. Fenald, chairman, town of Esplee, December 9:

On the 2nd of November a fire in the middle of the town about one or two o'clock P. M. burned over about 4,200 acres of prairie; damage \$2,000. A good many people worked beating it out with brush and sacks. There was a fire which started on section 10 and one which came from south of the town. There has been a dispute as to which caused the damage. Weather was windy and dry.

John Simonson, chairman, town of Excell, December 5:

November 16th a fire burned over 900 acres of low land but did no damage. It was extinguished partly by the use of wet sacks and partly burned itself out. Weather was windy and had been dry for two weeks.

Henry Roller, chairman, town of Grand Plain, November 6:

On the 5th instant a fire originating on section 35 burned over 500 acres of pasture; damage \$100. It was extinguished by 12 persons heading it toward the main



Exceptionally rich body of White pine forest on section 19, township 66, range 18. Photographed August 15, 1904, for the annual report of the Chief (Forest) Fire Warden of Minnesota.

road, which it did not cross. Fire was raging in all directions and has been most all fall; mostly on the land which is open to settlers this summer. Weather very dry and had been for months.

Same, November 20:

November 16th a fire which started in the adjoining town east crossed the line on section 25; burned over 400 acres and destroyed 65 tons of hay in stack; damage \$160. Was stopped by the road. There was a very strong wind, and it had been dry for months.

Same, December 6:

The first snow we got to stop fires was on the 28th of November. The trouble is that the north part of this town is one big swamp and ten miles farther here and there a settler. This is a great duck country, so every fall fires started by hunters are numerous and sometimes burn for ten days at a time and generally come into the settlements. It is impossible to do anything with them if it is very dry. On the south is the reservation and that has been taken up this summer, so I do not think we will be bothered so much from that side. This fall it was all burned over. This has been a very bad fall for fires on account of no rain.

Magnus Christianson, chairman, town of Moose River,
December 17:

On the 10 and 11th of November a fire, originating on sections 33 and 34, burned over 1,500 acres of meadow, destroyed about 30 tons of hay of the value of \$100. It was extinguished in 14 hours after it started by five persons with wet sacks. Weather dry and windy about a month.

C. A. Anderson, chairman, town of Spruce Valley, November 7:

October 29th a fire burned over 100 acres; destroyed 2 stacks of hay and did damage to the amount of \$80. It was extinguished by four persons with wet sacks. Dry and strong southeast wind.

P. B. Malberg, chairman, town of Viking, October 10:

October 6th a fire which originated a little southwest of this town close to the line between Polk and Red Lake counties burned over about 200 acres and destroyed some small groves; very little damage. It was extinguished by six persons by back-firing and the use of wet sacks. Weather very dry and wind from south.

C. Westman, chairman, town of West Valley, December 10:

November 19th a fire in the northwest part of the town burned over 200 acres and destroyed hay of the value of \$165. It was extinguished two days after it started. Weather dry and windy; had been for about a month.

NORMAN COUNTY.

J. H. Luchan, chairman, town of Green Meadow, May 23:

May 17th a fire originating on section 9 burned over about 640 acres and destroyed parts of two stacks of hay; damage \$30. Weather rather wet all spring.

POLK COUNTY.

Henry Ronne, chairman, town of Badger, November 16:

November 12th a fire which originated on section 23 in town of Terrebonne ran about 3 miles and burned over 2,000 acres; damage \$450. Weather dry with hard wind; has been dry for about three weeks. Thirteen persons of

our town started to fight it before it got into our town by breaking with teams and back-firing.

J. P. Saleating, chairman, town of Belgium, November 25:

On the 13th and 14th of November a fire which started in the southeast part of the town burned over 10 sections and destroyed groves and a few haystacks. It changed its directions several times with change of the wind.

Ole Morud, chairman, town of Helgeland, October 17:

On the 6th and 7th of October a fire which originated in the town of Bray, Red Lake county, burned over 6,000 acres and destroyed three stacks of hay; damage \$75. It was extinguished by plowing and back-firing and use of wet sacks. Weather dry and windy; had been dry for about four weeks.

Siver Quarberg, chairman, town of Onstad, September 29:

On the 24th instant a fire caused by a railroad locomotive burned over 800 acres and destroyed about 125 tons of wild hay; damage \$500. It was extinguished by plowing and dousing with wet sacks. Weather dry and windy and had been dry for about eight days.

A. P. Moen, chairman, town of Vineland, November 21:

On this date a fire which originated on section 5 by sparks from a locomotive burned over 250 acres and destroyed 88 tons of hay of the value of \$352. It was extinguished with the help of 20 persons by the use of wet sacks. Weather dry and breeze from northwest.

RED LAKE COUNTY.

C. P. Swanson, chairman, town of Bray, October 22:

On the 6th instant a fire originating on section 19 and caused by burning a fire-break spread considerable distance and did damage to the amount of about \$200.

Same, November 7:

The party who caused the fire paid a fine of \$10, besides \$37 costs.

Same, November 14:

On the 11th of November a fire which originated in the town of Polk Center came into this town on section 31; wind from southwest swept along the whole town and into the town of Numedal; then the wind changed and the fire came back in the middle of the night and swept over about half of the town of Bray. Fifteen persons fought it with small tree tops and a team was used plowing to save buildings. About 25 tons of hay were destroyed in the town of Polk Center.

Magnus Winberg, chairman, town of Numedal, November 12:

On the 11th instant a fire which came from the town of Bray burned over 3,200 acres, but did no damage. It was fought by twelve persons with brush, wet sacks and by breaking. Weather windy and dry over a month.

William Hebert, chairman, town of Poplar River, November 16:

A fire on the 12th and 13th instant originating on section 23 burned over 3 sections and destroyed three strawstacks of the value of \$20. Fought by plowing. Weather dry for about three weeks and windy

ROSEAU COUNTY

Paul Hogan, chairman, town of Barnett, November 8:

November 2nd a fire on section 6 burned over 600 acres; did damage to the amount of \$63 by burning hay. Weather dry for four weeks.

A. J. Gilseth, chairman, town of Deiter, November 26:

On the 21st of November a fire in the western part of the town burned over muskeg and meadow. Cannot state exactly number of acres, and destroyed between 500 and 600 tons of hay; damage \$1,800. It came from the town on the west. Weather windy, blowing about 40 miles an hour; had been dry for over a month.

Evan Erickson, chairman, town of Dewey, October 6:

On the 30th of September a fire originating on section 16, unoccupied, burned over 800 acres and destroyed over 100 tons of hay; damage about \$300. The farmers along where it swept tried to fight it but could not until it burned to a sand ridge and died out. Weather windy and had been dry for a week.

T. Segfusson, chairman, town of Pohlitz, November 26:

On the 22nd a fire originating on section 19 burned across the town and did damage to the amount of \$1,000. It was fought by 30 farmers with teams and by breaking. Weather dry for six weeks. Wind was blowing very strong all day.

Same, December 10:

I have been over the burned ground enough to know that it burned the north half of the town with the exception of some small spots which are mostly swamp land. There has been fire on this side of the Roseau river, but it did no damage.

STEVENS COUNTY.

E. H. Barnes, chairman, town of Everglade, November 3;

On the 2nd instant a prairie fire caused by burning stubble on section 34 burned over 1,200 acres of field, prairie and meadow and destroyed mostly hay in stacks;

damage about \$600 or \$700. The number of persons assisting in extinguishing the fire was 32, by plowing, back-firing and by whipping it out. Weather dry with very little wind; had been dry for fifteen days.

GRANT BY CONGRESS TO THE STATE OF MINNESOTA OF
20,000 ACRES OF LAND FOR FORESTRY PURPOSES.

Under a resolution adopted September 2, 1903, giving the Executive Committee of the Forestry Board power to act in the matter, a bill prepared by such Committee was introduced in Congress by Senator Nelson, granting to this State such vacant public lands for forestry purposes as the Surveyor General should from time to time certify were third or fourth rate. The bill was referred to the Interior Department and by that Department referred to the Department of Agriculture; but the Forester of the United States Bureau of Forestry objected to the bill as being too far-reaching and as setting a dangerous precedent. On the advice of Senator Nelson a bill was then prepared and by him introduced authorizing the State Land Commissioner and Forestry Board to select for experimental forestry purposes not to exceed 20,000 acres of vacant public lands within the State which according to the field notes of the government surveyors were third or fourth rate. The United States Forester approved of the bill with an amendment that it should not include any tract which in the opinion of the Forester should form a part of any United States forest reserve, and it was finally passed and approved April 28, 1904, with an additional amendment that the land granted should be cared for and managed by the State of Minnesota and used for forestry purposes only, and that if any

part should cease to be so used it should revert to the United States.

The bill had the cordial support of the Senators and whole delegation from Minnesota. Senator Nelson having promptly secured its passage by the Senate, its consideration in the House, by unanimous consent, and final passage were largely due to the active efforts of Representatives Volstead and Lind, who were both on the Public Lands Committee. The report of that Committee sets forth among other things that "It is considered that the State is favorably situated for making such use of this land. It has a well-organized forestry bureau, engaged in reforestation and in the management of its parks and forest lands. This bureau has practical knowledge of the situation and is vigorously sustained by the public opinion of the State."

The following is a copy of the Act:

An Act to Grant to the State of Minnesota Certain Lands for Forestry Purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:

That the State of Minnesota, through its State land commissioner and State forestry board, is hereby authorized to select for experimental forestry purposes not to exceed twenty thousand acres of vacant public land within said State not heretofore withdrawn or reserved, and as nearly as practicable in one body and from lands which, according to the field notes of the Government surveyors, are third or fourth rate; which lands are hereby granted to said State of Minnesota for forestry purposes: *Provided*, That said selection of lands shall have the approval of the Secretary of the Interior: *And provided further*, That no tract shall be included in this grant which, in the opinion of the Forester of the United States Bureau of Forestry, should form a part of any United States forest reserve.

SECTION 2. That it shall be the duty of the Secretary of the Interior to make accurate lists and plats of all such lands, and transmit the same to the governor of said State, to cause patents to be issued to said State therefor conveying to said State the fee simple of said lands: *Provided*, That this Act shall not prejudice any adverse claim to any of said lands: *And provided further*, That the land hereby granted shall be cared for and managed by the

State of Minnesota, and shall be used for forestry purposes only; and if the said land, or any part thereof, shall cease to be so used the said lands or such part shall revert to the United States and become a part of the public domain.

The lands were duly selected in June, 1904, certified by the Interior department to the State of Minnesota January 27, 1905; and a patent for the same, signed by the President February 16, was received by the Governor of Minnesota March 9, 1905. An act of the Legislature of Minnesota accepting the grant was approved by the Governor March 30, 1905.

DESCRIPTION OF THE 20,000 ACRES GRANTED FOR
FORESTRY PURPOSES.

The lands are situated on the Vermillion range in township 64, range 13, and township 63, range 13, in St. Louis county, and distant about twelve miles west and northwest of Ely, and were visited by me for the second time in July. They comprise a rugged forest region in a fine lake setting. Most of the surface is underlaid with granite upon which the soil is thin. There are hills eighty feet above the lakes commanding a handsome landscape. A few elevated areas are almost bare light colored granite, but upon which in the middle of July was found an abundance of blueberries. In low places the black alder is frequent and there are some swamps of dwarf spruce. In one of these a spruce with a diameter of only one and a half inches was cut showing forty-two rings, thus indicating it was so many years old.

As a whole the lands are densely covered with thrifty forest from ten to thirty years of age, of which the prevailing kind is jack pine, though there are groups, but not extensive, of Norway and white pine; and good specimens of both Norway and white of merchantable size are found scattered through the woods. Wherever there is a bit of



viewed as the nation's. Approximately 65 percent of the population of third- or fourth-rate land granted by Congress to the State of Minnesota for forestry purposes in 1857, and approximately 25 percent of the national output of the timber (timber) pine Warden of Minnesota.

good loamy soil the young white pine is trying to effect a lodgment. Poplar and white birch are frequent, and on the lower lands are spruce and tamarack of considerable value.

Along the lake shores and principal streams the moose and deer have made a trail which helps the woodsman in his progress. There are abundant evidences of wild game. I saw, however, but one moose, who appeared on the lake shore, within a hundred yards of our camp, at breakfast time.

The visit to this region was on charming summer days, when a flood of sunlight spread over the scene. Everything in nature seemed happy. Looking from a hill-top over an undulating expanse, the masses of pines like columns of soldiery, bending their tops to the light breeze as cloud shadows chased over them, seemed to express a holiday glee.

Within or adjoining these forestry lands are twenty-one lakes, generally deep, and with wooded, rock-bound shores. One of these, locally known as Crab Lake, is noted for its black bass. Some of the land borders the north end of Burntside lake, which is eight miles long by three or four miles wide at its widest place, has many handsome islands, on some of which are cottages of Ely people, and contains trout. Burntside lake is probably the most beautiful lake in Minnesota. The late Alexander Winchell of Michigan said it surpassed in beauty of scenery the Thousand Islands of the St. Lawrence.

As the State's forest, fish and game preserve, this twenty thousand acre tract will always afford valuable means of recreation for the public. One can visit these lands by boat all the way from Ely. Streams navigable for boats connect several of the lakes, and with moderate outlay water communication can be extended. It should not be very expensive getting the logs from this reserve to the

saw-mill at Winton. The most southerly part of the lands is not more than three or four miles from the Duluth & Iron Range railroad at Robinson station.

What will be the first steps the State will take with these forestry lands? It will do just as a business man would do if he owned them. It will take pains to protect them from fire which, in places where the soil lies thin on rocks, would destroy both timber and soil. It will, or should, have a careful survey made of the lands by competent foresters and map and report made showing the kinds, amount and value of the timber which should be marketed now and the amount that could be cut in ten or twenty years hence, the proper routes for roads and cost of building, and best ways of getting the timber to market; what portions, if any, of the lands should be artificially stocked with forest and with what kind, and what plan should be adopted for maintaining a sustained yield. Also the kinds of wild game that inhabit the forest.

NURSERY ON THE PILLSBURY RESERVE.

The Forestry Board at its meeting April 10, 1903, instructed the executive committee "to take charge of the Pillsbury donation of land in Cass county and take such action for the development of the same as they deemed expedient, including making permanent improvements and a nursery as soon as means were furnished by the legislature." In its annual report to the legislature of 1903 recommendation was made by the Forestry Board for an appropriation of \$3,584.50, to be available immediately, for permanent improvements on said Pillsbury reserve; also \$1,860.00 for each of the years 1903 and 1904 for annual expense of the reserve. An itemized

statement accompanied the recommendation. No part of these amounts, however, was appropriated.

The committee decided, however, to start a nursery, to be paid for out of the \$1,000 annual appropriation for the Board's expenses, and on the 29th of September, 1903, accepted the proposition of Lars M. Hope, a Norwegian-American homestead settler, living half a mile from the Pillsbury reserve, to prepare one acre for a nursery on the SW $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Section 1, Township 134, Range 30, that autumn, for \$28. The land he selected for the purpose was moderately sloping and consisted of light, loamy soil, which had been partly covered with a small growth of poplar and jack pine.

October 29, 1903, the Committee visited the Pillsbury reserve and found that an acre of land had been properly prepared for a nursery. Mr. Hope undertook to perform the labor of making lath screens and supports to cover half the acre, and brush screens and supports to cover the other half, at 15 cents per hour. The Pine Tree Lumber Company gave the State 12,000 laths for the lath screens. The work of making the screens was done in the winter. The spring was backward, and it was not until May 12th that the Committee again visited the nursery. They took 65 lbs. Norway spruce seed, 5 lbs. white spruce seed, 10 lbs. white pine seed, 5 lbs. Scotch pine seed, and 1 $\frac{1}{2}$ lbs. jack pine seed, in all 86 $\frac{1}{2}$ lbs., and on the 13th of May started the work of sowing.

The Committee again visited the nursery on the 21st of October and found it in a fairly satisfactory condition. It was estimated that there were 800,000 young trees in a thrifty condition, consisting mostly of Norway spruce, and the Committee were on the whole well pleased with the situation.

PELICAN LAKE COUNTRY.

Some of the richest bodies of pine forest remaining in Minnesota, and which are still standing in their primeval grandeur, are in the region of Pelican lake, in the north-western part of St. Louis county. They are nature's masterpieces in vegetation. I visited for the first time some of these forests about the middle of August. Much of the white pine is growing on very fertile black soil, and its density is such that in a few instances a quarter section (160 acres) of land will yield 4,000,000 feet of lumber, and of the value, as the timber stands, of \$20,000. Sixteen years ago it was worth only a tenth part as much. The Duluth & Rainy River railroad is approaching this region and in a few more years will have carried off the pine. I reached this locality by steamboat from Tower to the head of Vermillion lake, where is a stopping place; thence by wagon seven miles over very rocky road to Elbow Falls, easier, however, though farther, by canoe from Black bay of Vermillion lake, via Elbow lake and river with four short portages; thence by canoe down Elbow river into and down Pelican river; also up Pelican river into Pelican lake.

The general appearance of the country is a sort of medium between bold and tame. There are no elevations much exceeding one hundred feet. Pelican lake, which has an area of almost a township, contains numerous islands which, like its shores of varied landscape, are wooded and often rocky. The prevailing character of the more elevated portions of the country is rocky, but there is a fair amount of arable land. The streams are sluggish and often bordered by meadows of luxuriant blue joint grass. There is much wild rice in the waters and occasionally the canoe has to struggle through fields of it. The muskeg swamp of stunted spruce, though unwelcome, puts in an appearance. The dwarf willow is often mo-

notonous, but from time to time the ash and oak, good witnesses of fertility, appear along the river banks. While pine is the principal and more valuable timber there is considerable good spruce and cedar, birch and poplar.

Some ragged spots are passed in course of a half day. Hillsides burned over years ago, now partly covered with bushes of cherry and birch or patches of wild flowers, some ridges thinly wooded, faced with bare rock and wearing more a frown than a smile. While making the portages one sees and tastes how abundant and especially nice the blueberries are the season of 1904. A dealer at the head of Vermillion lake paid to the Indians \$800 for blueberries during the season. I probably met forty Indians, including women and children, in canoes, who were or had been picking blueberries.

There is much to awaken interest while canoeing on the Pelican river. If the banks are marshy one often sees where the moose had lately wallowed. Suddenly some ducks fly up or are seen a little way off on the water, or the rail or the snipe appears. Of hawks, owls, cranes and crows there are plenty. On the portages some partridges were seen, also fresh signs of the deer and bear.

On this trip, as on others, I was impressed by the amount of young pine from six to ten years old, which in so many places is already growing. In the aggregate it represents a good deal of value.

WHERE MINNESOTA PINE GOES.

In October I again visited the Rainy river country and saw fresh evidence of the increasing consumption of Minnesota pine timber, particularly at the town of Rainy River, situated on the Canadian side of Rainy River, and which has two extensive sawmills, one of American own-

ership, said to be as complete as any in the Northwest. The extensive piles of sawed lumber there, covering an area of almost a good-sized farm, are the product mostly of Minnesota forests, and are destined for the widespread market of the Canadian Northwest by various railways. A man who had just made a trip on the Big Fork river, told me that that river was full of pine logs, and that is but one of our streams down which logs float to these mills.

A great deal of our Minnesota pine timber passes through Red lake, thence down the river to Crookston and, after being sawed there, is shipped into the Dakotas.

A very considerable part of the pine timber on the Chippewa reservation is being floated down the Mississippi to Dubuque, Iowa.

About four hundred million feet of Minnesota pine timber is annually shipped from Lake Superior ports to Eastern markets.

These are but samples of the ways that our Minnesota pine timber is being every year cut and shipped out of the state.

RESPONSIBILITY FOR RAPID FOREST CONSUMPTION.

I think there is a confused idea as to the responsibility of lumbermen for the destruction of forests. That the timber lands belonging to the United States are being, and for many years have been, disposed of in a lavish manner is the fault of Congress, for which the people as a whole are responsible. The lumbermen having invested their capital in standing timber have a right to cut it, and they will do so just as fast as they can find a good market. There may be forest land around the sources of the principal rivers that is better adapted for forestry than for agriculture, and which should be kept in forest because it would help to maintain waterflow and be

for the public interest. But we cannot expect individuals to hold forest land for the benefit of the public. If the public needs such land to be kept in forest, it should buy it and hold it for that purpose, the same as the states of New York and Pennsylvania are now doing.

NATURAL REFORESTATION.

The prevention of forest fires does much towards natural reforestation, but not enough in all cases. There are many bare places in the pine forest regions of Northern Minnesota that will never produce valuable timber without artificial help. Probably not more than 30 per cent of the cut-over and waste lands will ever become well stocked with valuable timber if nature unaided is depended upon. Experience abroad confirms this. For example, in the forest of the Uddeholm Company, comprising 400,000 acres of broken country in the province of Vermland, Sweden, and which I visited thirty-five years ago, not over 20 per cent of the cut-over area becomes restocked by natural seeding, and partly because much of the land is very stony and subject to spring and summer drought. In twelve European states, practicing scientific forestry and where forest fires are very exceptional and natural reforestation extensive, 101,000 acres in the aggregate of state forest land is annually reforested by artificial planting or sowing.

Besides, natural forest is seldom if ever as well stocked as that which has had artificial help. A scientific forest of mixed timber, at the age of 80 years, contains about 350 trees to the acre. An acre of natural forest of that age would seldom average half as many.

WHY THE STATE SHOULD OWN FOREST.

While most of the forest in Europe is owned by individuals, nearly all of the European states separately own

and manage considerable forest land, though not of course in one body. Amidst, though not a part of, these forests, are occasional farms, villages, and many people. The forests are generally traversed by good roads. Prussia owns 6,000,000 acres of state forest, from which it derives an annual net revenue of \$9,000,000. France owns 2,100,000 acres of state forest, from which it derives a net annual revenue of \$1.91 per acre.

Why should the state own forest? Because on light soil, unfit for agriculture, it takes on an average about eighty years for pine forest to grow to merchantable size, and individuals will not engage in the business on a large scale.

The area of land in Minnesota which has yielded pine is, in the aggregate, 18,000,000 acres, and it may be assumed there are at least within this area as many as 3,000,000 acres of rocky, hilly, or sandy land that is unfit for agriculture and which should be used for forestry. It may be asked if the state does not now own enough land? The State of Minnesota now owns about 2,500,000 acres of land, given by Congress, which by law it *must sell*, and for not less than \$5 an acre, for school and state institution funds. Besides, the greater part of these lands is suitable for agriculture. They cannot possibly be taken for forestry.

Saxony has 432,000 acres of state forest, the annual growth in which averages 225 feet board measure per acre, so that 97,000,000 feet board measure can be cut yearly for revenue without impairment of the capital. At the same rate of growth the 3,000,000 acres in Minnesota should, in eighty years, when it becomes a normal forest, begin to yield 675,000,000 feet board measure annually, and which, at \$5.00 per 1,000 feet, the present rate (the value will probably be double then), will be worth, standing in the woods, \$3,375,000 as net revenue.



Sample of 20,000 acres of forestry land granted to the State of Minnesota by Act of Congress, approved April 28, 1891. This tract is situated in township 6A, range 14. Photographed July 16, 1904, for the annual report of the Chief (Forest) Fire Warden of Minnesota.

In Germany, each 100 acres of forest gives steady employment to one workman, who lives in or near the forest with his family. He has skill and training, and, to be contented, must have good wages. In the same proportion, our 3,000,000 acres of Minnesota state forest would give steady employment to 30,000 workmen, who would represent an orderly population in the forest of 120,000. Among other indirect benefits, the forest would promote water supply in streams, beautify landscape, fertilize soil, ameliorate climate, afford covert for game.

The remaining original pine timber in Minnesota will be cut within the next fifteen years. There is some new growth coming on, and, while pine will always be cut in Minnesota, the great logging industry which now employs 15,000 men every winter will suffer a great decline.

The population of the United States increases 18 per cent every ten years, and the population of Minnesota increases more rapidly. The demand for forest products will increase.

In 1897 the State of New York owned about 1,000,000 acres of forest in the Adirondacks, since which time it has purchased, through its Forest Commission, mostly in the Adirondacks, but partly in the Catskills, 437,000 acres more, for which it paid \$1,697,448, being an average of from \$2.56 to \$4.26 per acre. It now holds 1,437,000 acres of state forest. There remain 1,200,000 acres of forest land in the Adirondacks, which it is expected the state will acquire for about \$2,000,000.

The Forestry Commission of Pennsylvania has purchased 700,000 acres of forest land at an average price of \$2.75 per acre, and is continuing the work. The purchase of land for forestry in both these states is properly regarded as an *investment*, and not as an expenditure.

PLANTING PINE AND SPRUCE ON FARMS.

Often there is a piece of land on a farm that can be utilized in growing pine and spruce timber. On fairly good soil and in sheltered situations the white pine (*Pinus strobus*), a favorite tree, will grow to merchantable size in from thirty to forty years. Such a piece of timber would not only yield a good money return but would lend beauty to the farm.

To raise such timber on prairie land it is absolutely necessary to grow a windbreak on the south, west and north sides. On these sides a strip of land about ten feet wide should be cultivated two years and then two rows eight feet apart of Golden willow should be planted, which can be done either by planting small trees or by planting cuttings, in each case to be eighteen inches apart. If cuttings are used they should be about twelve inches long, placed slanting in the ground, leaving one or two buds out of the ground. To prevent snow drifting onto the plantation some successful prairie farmers prefer two rows of willows two rods apart, the intervening space to be used for clover or timothy. Some highly recommend instead of Golden Willow the *Populus deltoideis* or *monilifera*, a species of Cottonwood, called by Michaux the Virginian poplar, a tree very common in France and Switzerland, believed to have been introduced into Europe from America, and known in some places in Minnesota as the Norway poplar. Whatever kind of tree is used for a windbreak the whole strip of ground comprising two rows should be kept cultivated; also mulched with hay or straw to preserve moisture and to suppress weeds. As both these kinds of trees, though rapid growers, are comparatively short lived, it would be well to begin, when convenient, to supply the place with evergreens, such as the Norway spruce and Scotch pine.

When the trees composing the windbreak are two years old one can begin planting the pine and spruce. If the land on which the planting is to be done is not too rocky or hilly it should first be plowed and cultivated, and even after planting is done cultivation should be continued long enough to keep down weeds until the plants reach such size that their shade will be sufficient to suppress weed growth. If the ground is level so that it can be furrowed furrows will facilitate the planting. If the ground is so rocky and broken that it cannot be plowed, then the soil in the spots in which the plants are to be set should be loosened.

The best success is with small trees. As a rule it is not advisable to use plants over four or five years old, and the planting will generally be more successful if they are younger. Spruce seedlings can be imported from Germany in considerable quantities at \$2 per thousand. Probably there will be no difficulty in obtaining pine and spruce seedlings from reliable nurserymen in this State, but the farmer can economically raise them himself. He can obtain seeds from responsible nurserymen and can sow them in nursery beds of well cultivated but not rich soil in shallow drills six inches apart, the seeds about an inch apart and to be lightly covered. Sowing should not be done when the ground is wet. For the first summer the beds should be covered with screens, either lath or brush, to protect them from the sun, as shown in the illustrations in this volume of the nursery on the Pillsbury reserve, and be covered with hay or straw the first winter.

Seedlings are plants grown from seeds. A transplant is a seedling which has been taken from its original bed and replanted in a nursery bed, temporarily, from one to three or four years before being set out where it is to remain permanently. In making a plantation of pine and spruce, two year old seedlings are quite often planted suc-

cessfully; but probably the best success will be obtained by using transplants that are two years old. In either case plants may be set four feet apart, which would require 2,730 plants to an acre. They are sometimes set three feet apart and even closer. Care should be taken that the roots have a natural position and the earth firmed around them. In dry situations they should be a little below the ordinary surface. The plants should be taken up, handled and planted with the greatest care and the roots never for a moment be exposed to the sun or dry air. The roots should be covered with moist soil until planted. Planting should be done in the spring soon after the frost is out of the ground and preferably in cloudy and damp weather. In very dry seasons mulching of the ground may be necessary.

A good combination for a coniferous plantation is white pine (*Pinus strobus*) and Norway spruce (*Picea excelsa*). They could be planted in alternate rows. One can follow his own taste in mixing other sorts. Our white spruce would be as satisfactory as the Norway spruce if it could be as easily obtained. Also in places where the soil is very sandy and poor our so-called Norway pine (*Pinus resinosa*) and jack pine (*Pinus banksiana*) would do well. On any more fertile spots some good hardwood varieties could be planted and partly to attract singing birds. The absolute necessity of great care and pains in all of such work cannot be too strongly emphasized.

PRESENT GERMAN METHOD OF PLANTING PINE.

Through the American Embassy at Berlin I was recently kindly favored with the following information furnished by the Prussian Government on the method of planting pine in Germany, in answer to questions I submitted the 23rd of February:

Question 1. What is the most common and successful way of raising forest of pine (whether white, *pinus strobus*, or Scotch *pinus silvestris*) on bare land?

Answer. The common Scotch Pine, as well as the American White Pine, is well adapted for reforestation of abandoned fields, abandoned pastures and wastes.

Both species thrive on soil of somewhat poor and dry qualities, yielding fair returns on such soil. There is no difficulty combined with the planting of these species.

The common *Scotch Pine* can be raised by planting seeds as well as by planting young plants.

The method of raising to be preferred in a given case depends on the quality of the soil, on the amount of labor available, and on the price of seeds.

The planting of plants is preferable on soil covered with weeds or on very dry soil. On fresh soil, unless the weeds are rank, the planting of seeds answers as well.

The planting of plants requires a well trained force of workmen; much more so than the planting of seeds. For the preparation of the soil, as well as for the act of planting, careful supervision is required. The success of a plantation of plants depends on a thorough loosening of the soil. The depth to which the soil is worked depends on the size of the plants. In the case of seed planting such thorough working of the soil is not required. (Compare No. 4.)

When the price of seeds is high it is advisable to raise the plants in a nursery, where a larger percentage of germinating seeds is obtained. The plants raised in the nursery are then planted in the open ground.

White Pine is usually planted as a seedling or as a transplant. The price of the seed is too high and the grain too large to allow of seed planting. A pound of seeds contains a relatively small number of grains. Further, the germinating power of the seed of White Pine is small. Thus it is necessary, in the case of seed planting, to use a large quantity of expensive seed to secure a good success in the open.

For these reasons the planting of plants is customary.

The young plants are raised in a seed bed and transplanted when one year old; they remain for two years in the transplanting beds and are used for planting in the open when three years old.

It is advisable, where the ravages of seed-eating birds must be dreaded, to coat the seed planted in the nurseries or planted in the open with a light coating of red lead, poisonous for birds.

Question 2. If the most common way is by seedlings from a nursery, at what age are the seedlings planted where they are to remain permanently? How far apart are they planted, and what, if anything, is done after they are planted to protect them from the sun?

The Scotch Pine plants, commonly used for planting in the open, are seedlings *one year old*, only, raised in the seed beds of a nursery.

In exceptional cases transplants of Scotch Pine two years old are used, notably, when the young plant is apt to suffer from the competition of weeds, or grasses, or other woody species.

The planting of plants is preceded by careful cultivation of the soil, which insures good conditions of growth for the finer root fibres. The cultivation takes place usually in the fall of the preceding year, whilst the plantation itself follows as early as possible in spring. The preparation of the soil is done either in spots or in strips. [Thorough plowing of the entire ground to be planted is very rare.—Translator.] As regards the planting spots, they are freed from the cover of weeds; they measure a foot square; they are worked to a depth of one foot—the work including the removal of roots and stones; and the distance at which they are placed apart does not exceed four feet four inches from center to center.

On each of these spots at least two seedlings one year old are planted in the clefts made with a planting dagger. In exposed situations as many as four seedlings one year old are inserted in each spot.

Where transplants two years old are used it is absolutely necessary to plant *very early* in spring. Two such transplants are planted in each spot. Their root system is usually so large as to make it advisable to plant more carefully by the use of the hand and not merely by using the “cleft spade” or the “planting dagger.”

Where the soil is worked in strips or belts, the width of the belt is one foot to one foot four inches. The depth to which the soil is worked is one foot. The distance at which the strips are laid apart must not exceed four feet four inches. The preparation of the soil takes place in fall.

Within these strips are planted, at a distance of one foot and eight inches apart, either pairs of Scotch Pine seedlings one year old or one transplanted Scotch Pine two years old, the method of planting being as previously described.

The transplants of White Pine are planted, three years old, either on the strips or on the spots, in open holes made with a spade immediately before planting. The planting is done by hand merely.

No special device is required in Germany to protect the plants against excessive insolation.

Question 3. If it is necessary or very beneficial in such planting that other kinds of seedlings be mixed with pine, please state why and what kinds.

Answer. It is not *necessary* to raise a mixed forest. On pure Pine soil [which term describes in Germany a soil of poor physical qualities.—Translator] it is rather difficult to plant any species but Pine with the hope of success. In Germany, the only hardwood species which might be efficiently mixed with Pine on poor soil are American Black Locust, robinia pseudacacia, and White Birch, betula verrucosa. The list of hardwoods from which the German planter may select for such plantations on poor soil is very small, hardwoods, on the whole, being more exacting than Pines.

On the other hand, the mixture of the two Pines, namely, of Scotch Pine and of White Pine, is *possible* on poorer soil even and deserves to be recommended.

On better soil where the valuable and exacting hardwoods find a living, the plantation of Pines in mixture with the hardwoods can be advocated only in case of the inadvisability of abandoning Pine as a composing member of the growing stock.

Economic reasons or else the condition of the soil control the answer to this problem. Aside from the fact that a mixed forest of Pine and hardwoods supplies the market with a great variety of products, such a mixed forest offers the advantage of retaining the productiveness of soil or that of even amending it.

The common Scotch Pine, already during the polewood stage, places the individual tree far from its neighbor, through natural rapid thinning, and thus allows the sunlight to desiccate the unshaded soil. In addition, the common Scotch Pine, by its scant fall of needles, increases the productiveness of the soil but

slightly; in mixture with *White Pine*, however, which develops a much denser canopy, and in mixture with broad-leaved species, the soil is better protected from direct insolation and is continuously fertilized by a plentiful fall of needles and leaves.

In addition, the physical qualities of the soil are improved by the formation of layers of humus capable of soaking up the precipitations falling upon it like a sponge and yielding the waters only gradually to evaporation or percolation.

Amongst the broad-leaved species mixed with Scotch Pine on soil of better quality, in Germany, the following species rank foremost: The Beech, *fagus silvatica*, and the Ironwood, *carpinus betulus*.

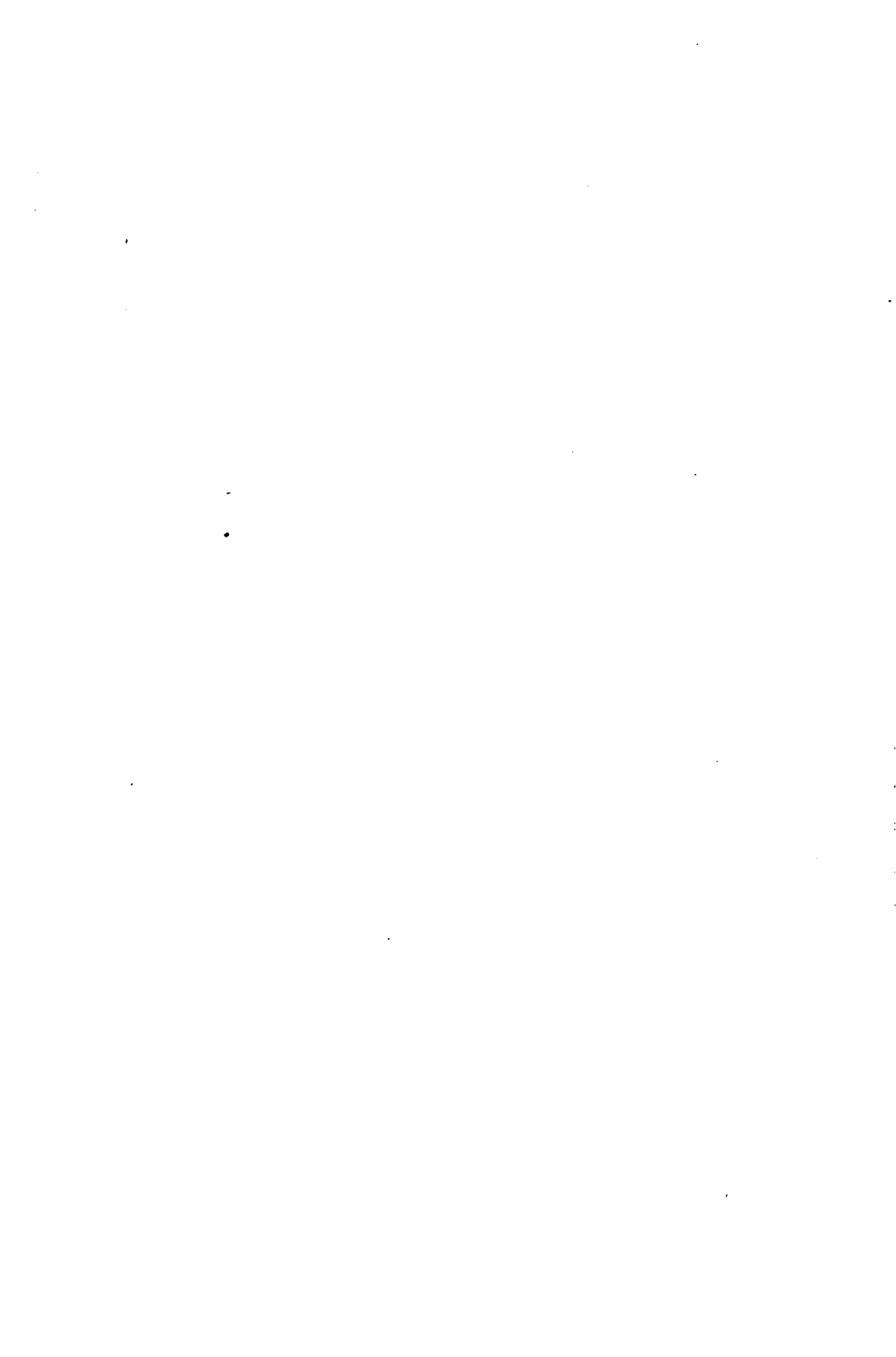
Amongst the conifers to be mixed with Scotch Pine, the Spruce, *picea excelsa*, the Fir, *abies pectinata*, and the Larch, *larix europaea*, are worthy to be mentioned.

The Beech and the Fir, where the danger of late frosts prevails, can be regenerated only, however, under cover of old trees overhead, unless these species are planted merely for the benefit of the soil underneath the Pines during the polewood stage of the latter.

In Germany the late frost plays havoc with Beech or Fir planted in the open.

The mixture of these several species with the Scotch Pine can be a mixture by individuals, singly, or else a mixture in larger groups. The method of mixture to be selected depends on the rate of growth of the species mixed and their tolerance or intolerance of shade. On the whole, it can be given as a rule that a mixture by single individuals is employed only when the species to be mixed show, on a given soil, the same rate of height growth, or else if a species intolerant of shade shows a faster height growth than a tolerant species mixed with it; or, finally, when the light-demanding species, planted in stronger and older specimens, obtains an advantage at the start over the shade-bearing species.

Question 4. If reforestation is done by sowing pine seeds direct in hills [I used the word as when we speak in this country of a hill of corn, though the surface has no mound formation] or patches, what is the usual distance between such hills and what precautions, if any, are taken to protect the plants from the sun or other danger after they have come up?





Part of the 20,000 acres of forestry land granted to the State of Minnesota by Congress, showing big granite boulder. Photographed July, 1904, for the annual report of the Chief (Forest) Fire Warden of Minnesota.

Answer. As regards the distance from one planting spot to the other, we refer to our answer to question No. 2.

It is not customary in Germany to plant seeds on mounds. This method might be justifiable where the growth of weeds is rank, or where the character of the soil is swampy.

In such cases, however, the planting of plants is usually preferred to the planting of seeds. Planting of seeds in spots, in the case of conifers, is rather rarely resorted to.

The usual method of seed planting is that of planting in strips. These strips are one foot to one foot four inches wide. The vegetable cover found on them is peeled off. The distance from center to center between the strips is four feet to four feet four inches.

These strips are worked with the hand-hoe merely and only rarely treated with the bull tong plow.

The seed coated in red lead is best planted with the help of seed-sowing machines; for instance, Spitzenberg's seed-sowing machine. The seed is planted in spring. No protection is given in Germany against excessive insolation, for the benefit of the young germinating plant. It would be rather difficult, of course, to offer such protection on waste land or other open ground. A certain amount of protection may be secured by running the strips in an easterly and westerly direction and by heaping the soil cover removed from the strips between the planted strips. In hilly or mountainous countries the strips for planting seed, as well as for planting plants, are run entirely horizontally, so as to prevent erosion along the strips.

COMMENTS BY DR. SCHENCK.

In transmitting to me the foregoing translation of the paper furnished by the Prussian Government Dr. C. A. Schenck, the able superintendent of the Vanderbilt forests at Biltmore, North Carolina, submitted the following remarks:

"The method of raising White Pine advocated in this paper is not customary everywhere. In many cases seedling plants two years old are planted at once in the open

without transplanting. Also, in many cases where transplanting of White Pine is practiced, transplants four years old are used. We, at Biltmore, have tried all of these methods. On fairly good soil it is very much cheaper and just as effective to use seedlings two years old. On very steep washing soil we go to the other extreme of expense and safety and plant White Pine transplants four years old.

During the current year we have planted some two hundred acres of White Pine in mixture with Yellow Pine, with maple, with Tulip trees, with Chestnut Oak and so on."

STATESMEN'S DUTY IN FORESTRY.

The true statesman has regard for the future as well as the present. Had it not been for a few statesmen who thirty years ago looked to the future, Minnesota would not now have a permanent school fund of \$16,000,000. In forestry especially one has to regard the future.

Minnesota is one of the natural pine bearing states. The utilization of forest products has for fifty years been a leading industry. Some pine will always be cut in our state, but the remaining original pine will mostly be cut within the next ten or fifteen years. After that we shall no longer see 15,000 workmen employed as now each winter in our northern pineries.

Remember that besides dollars and cents the forest yields many indirect benefits which concern the whole public. To the farmer it is a barrier against the cold north wind and the hot south wind. The forest is a natural reservoir of moisture maintaining water flow in streams. It beautifies landscape, ameliorates climate, enriches soil, affords covert for game.

The great economic fact in forestry is that pine forest is a profitable crop on non-agricultural land—land that is too hilly, too rocky or too sandy for cultivation. On such land the pine will by its annual growth earn on an average net annual interest at the rate of three per cent on the capital properly invested; but as it takes about eighty years for pine on such soil to reach merchantable size, individuals will not engage in the business. It must be undertaken by the state if we are to renew for future generations our forest resources.

A forest is in a normal condition when it has trees of different ages so that enough mature trees can be cut yearly or every period of five or ten years according as the market is good, for regular revenue, leaving the space cleared to be naturally or artificially reforested. The forest is thus a perpetual revenue yielding capital.

There are in scattered localities in northern Minnesota fully three million acres of rocky, hilly or sandy non-agricultural land, a part now held by the United States and the rest by private owners, which is only fit for bearing pine. Portions of it already have trees from which revenue soon could be derived. This land the state ought to acquire and put and keep in forest. Congress has already granted to the state 20,000 acres of such land and no doubt will donate more if it sees the state makes good use of what has already been given and making some sacrifice for obtaining some of the cut-over non-agricultural lands belonging to private individuals.

We belong to a generation that does things. Minnesota on account of its natural forest advantages and interest ought to be in the very front rank in forestry. But if we are not careful other states will get ahead of us

EUROPEAN FORESTRY.

No intelligent friend of forestry supposes that the science of forestry will, for a long time, produce in this country the results which are seen in many of the densely peopled states of Europe, but a knowledge of these splendid results is very instructive and stimulating, and for that reason I have taken pains to diffuse such information. The science of forestry is the same everywhere, but its application depends upon the conditions which are found in different countries. Let us assume that there is a natural coniferous forest on non-agricultural land in Germany in which 75 per cent of the trees are mature and 25 per cent have not reached merchantable size. According to scientific forestry the 75 per cent of mature trees will be cut just as soon as the market would justify and the 25 per cent of trees of unmerchantable size would be left to grow till they should be fit to cut. A similar natural forest in this country would be treated in the same way, if treated according to forestry principles; and some lumbermen, such as those, for example, who hold pine lands in the valley of the St. Croix river or on its tributaries in this state, and who have gone back every fifteen or twenty years to make a second, third or fourth cutting on the same land, are managing their forests in this way. In cases where pine lands are remote from streams of capacity for floating and where the pine is reached by temporary logging railroads, clean cutting is made of both large and small trees; but lumbering of this latter description is in violation of forestry principles. If a trained forester were to commence cutting a mature forest he would not begin on that side of it which is exposed to the prevailing wind, because if

he did every cutting would freshly expose the remaining forest on the side of the cutting to dangers from the wind. Instead of that he would begin on the side opposite the prevailing wind, leaving the forest border, long years hardened to the wind on the windward side, as a protection to the forest. Now, that is a principle of scientific forestry and is just as applicable in this country as in Europe. Again, a trained forester in Germany would manage the cutting so as to promote natural seeding from the nearest trees left standing, and that principle is just as applicable in this country as in Europe. If a person in this country were to begin to manage a natural forest on forestry principles he would first have it surveyed; he would ascertain the number, contents and situation of the mature trees; he would gradually make necessary roads; he would make a map of his forest and prepare working plans for its administration and ascertain where he could sell the mature trees at the highest price; these would be the essentials that he would perform, and he would be doing just the same as a German forester would do with a forest in Germany. Owing to the denser population, cheaper wages, better roads, and very much higher value of land and forest products, the results of forestry are very much different there from what they are in this country, or will be for many years. But the cause of forestry in this country will be greatly promoted by diffusing a knowledge of European forestry; and for that reason I reprint from my last report sketches—obtained at great pains and in many instances direct from the respective governments—of the forests and forestry of several European states. A few sketches have been slightly abridged.

ALSACE-LORRAINE.

STATE FORESTS.

Aggregate extent, 338,500 acres, situated in the valleys of the Rhine and Mosel rivers and on the Vosges moun-

tains. The prevailing kinds of trees are fir (*abies pectinata*), spruce (*picea excelsa*), pine (*pinus sylvestris*), oak and beech. The average estimated value per acre is about \$100. Annual aggregate expense of administration, \$862,000; annual aggregate revenue, \$1,712,000; average net profit per acre, \$2.50. The number of acres annually sown with seeds, 610; planted with seedlings, 1,250 acres. On 2,750 acres the surface of the ground is roughly opened with spade, plow, harrow or hoe with a view to facilitate the germination of self-sown seeds. On about 50 per cent of the entire area, reforestation is effected by self-sown seed from standing trees; on about 35 per cent of the entire area planting trees, and on about 15 per cent planting seeds is resorted to.

There is a continuity of forest produce. The annual yield or cutting of the forest is not allowed to exceed the annual production. A decrease of the growing stock, by over cutting the forest, would be considered a criminal offense on the side of the forest administration. The general increase of the productiveness of the forest, however, permits of a gradually, but slightly, increased annual output. The forests consist of more or less averaged sections termed "compartments." Every compartment yields periodically (say in the 50th, 70th and 90th year of the tree life) a certain "intermediate yield," composed of immature trees, removed by way of thinnings. When the remaining trees reach financial maturity, they are removed either by a clean sweep or gradually, the removal proceeding hand in hand with the development of the second growth started underneath the mature trees (fir and beech).

The cutting of forests, with a view of using the soil for agriculture or pasture thereafter, is strictly prohibited since 1803, unless, under certain stated conditions, permission to the contrary effect is granted by the civil government. Any forest ground cleared from tree growth must be planted up within three years after such clearing, if in the opinion of

the forest administration regeneration from self-sown seeds cannot be depended upon. The owner of unproductive lands, when proposing to plant such lands to forest, receives certain contributions out of the treasury of the state. Plantations made on the tops and on the steep slopes of mountains, also plantations made on dunes and on unproductive prairies densely clothed with ligneous weeds, are free from taxes for 30 years. The amount of damage annually caused by forest fires is very little; no data available. The principal cause of such fires, when they do occur, is the careless use of matches and cigars thrown away burning. Very few such fires are annually caused by railroad locomotives; no data available. It may be estimated that in Alsace-Lorraine, as in Prussia, 10 per cent of all forest fires are caused by sparks from locomotives.

The forest service is entirely co-ordinate and equal to the other branches of the public service. The average salary per annum of the "Land Forst Meister" (forest counselor) is \$2,000; of the "Forst Meister" \$1,500; of the "Oberförster" (district manager) \$830; and the allowance for office and traveling expenses of each officer is \$500. All forest officers have the use of an unfurnished house free of charge.

PRIVATE FORESTS.

The aggregate extent of private forests is 771,000 acres, of which 546,000 acres are managed on forestry principles, being owned by towns, villages or public institutions. The forests owned by private individuals proper, aggregating 225,000 acres, are managed at the will of the owner except as above stated. The average value per acre is uncertain; it depends on growing stock, accessibility, quality of soil, etc. However, the average value of the private forests may be roughly estimated at \$75 per acre. The average annual rate of net income is between one and one-half and four per cent. The total forest product of Alsace-Lorraine

is well sustained. The municipal forests yield 70 cubic feet per acre per annum. This quantity is equivalent to about 140 feet of lumber, board measure, and one-half a cord of fuel. The population of Alsace-Lorraine is 1,605,000. The area of the entire territory is 3,625,000 acres, of which 1,110,950 acres are under forest. The annual yield of raw material is 61.1 $\frac{1}{2}$ cubic feet per acre. Of this amount 40 per cent consists of timber, and 60 per cent of fuel, corresponding with about 170 feet timber, board measure, and four-tenths cord of fuel. The cost of cutting timber and fuel, inclusive of sawing into logs, piling along wood roads, etc., amounts to one and one-tenth cents per cubic foot. At this price the workmen earn 43 cents per day. The value of timber, dragged to forest roads, is 9 $\frac{1}{2}$ cents per cubic foot, on an average. The value of fuel, piled up along roads, is three and four-fifths cents per cubic foot, or about \$3.42 per cord. The stumpage of timber is worth about \$12 per 1,000 feet, board measure. In the state forests about \$80,000 are spent annually for road improvement and forest railroads. The exclusive right of hunting is periodically leased to the highest bidder, under certain restrictions. These leases yield annually about 4 cents per acre. In the season of 1893-94, for instance, there were killed, in certain districts aggregating 320,000 acres, 42 head of red deer, 451 head of roe deer, 175 head of wild boar, 2,555 hares and 24 capercaillies (mountain cock), besides a number of minor animals.

AUSTRIA.

STATE FORESTS.

The entire forest area of Austria is, in round numbers, 24,000,000 acres, of which the state administers 2,573,940 acres of actual forest, and of which 800,000 acres belong to religious, educational or charitable endowments. Under the Department of Forestry there are eight territorial



In the Black Forest near the City of Freudenstadt in western part of Wurtemberg, Germany. Railroad right-of-way planted with maple and locust trees to guard against setting fire by sparks from locomotives. These woods on the right-of-way are cleared twice a year of combustible material, such as sticks, leaves, etc.



On moose trail. Part of the 20,000 acres of forestry land granted to the State by Congress. Photographed July, 1904, for the annual report of the Chief (Forest) Fire Warden of Minnesota.

offices, and under these eight territorial offices there are 186 local offices. The largest area under the supervision of a single territorial officer is 628,225 acres; the smallest area under the supervision of a territorial officer is 191,498 acres, whilst the average is 452,762 acres.

Including unproductive soil a local range comprises in one case as much as 120,726 acres. If only the productive forest area is drawn into calculation, the maximum size of a local range is 58,993 acres, whilst the minimum is only 1,030 acres. The average size of the forest area under the management of a single local officer is 13,880 acres.

There are two distinct groups of forests administered by the state authorities—one in the east, comprising lands in Galizia and Bukowina, and one in the west, comprising the Alps. Besides, there are some smaller forests lying in the southern and the northern sections of the empire.

Twenty-six per cent of the state and fund forests are lying in the plains and at the foot hills.

Forty-nine per cent of them are lying in the mountains, at medium elevations, growing under conditions favorable to tree growth.

Twenty-five per cent of them are lying in the highest mountain region, extending up to the limit of tree growth.

The species covering most ground is the European spruce (*Picea excelsa*), occupying 49 per cent of the entire forest area. Beech is next, occupying 20 per cent. Then follows the fir, occupying 19 per cent, and the larch, occupying 5 per cent. A small area only is in possession of the pines (only 3 per cent). The balance of 4 per cent is occupied by alder, linden, maple, oaks, elms, aspens, willows, etc. It appears from these figures that the Austrian state and fund forests consist of coniferous woods to the amount of three-quarters and of hard woods to the amount of one-quarter.

In the Alps spruce reaches up to an elevation of 2,000 meters (or 6,562 feet), and in the Karpath mountains to

an elevation of 1,500 meters (or 4,921.5 feet). It forms, especially on the high mountain ranges, pure forests in many cases. However, it is often found mixed with other conifers and with hardwoods. In the very highest mountains it shows a poor growth, short boles and bad form, the diameter increasing rapidly from the root to the top. The branches are running down to the ground and are covered with lichens. Spruce thrives best on slightly sloping ground protected from high winds, where the underlying ground is a sandy loam formed from slate. Here the tree shows long, straight and clean boles. However, spruce is found thriving in almost all situations.

Silver fir (*Abies pectinata*) is mostly found mingled with beech, horn-beam and spruce. It does not run as high up in the mountains as the spruce will do. However, it is found in the Karpath mountains at an elevation of over 1,500 meters (or 4,921.5 feet). Pure forests of fir are found only in a few places (Vienna forest, Karpath mountains and Krain).

Larch (*Larix Europæa*) is scarcely ever found forming pure forests. Its favorite ground is an eastern and northern slope where spruce is the predominating species. Under these conditions it rises as high up as 2,200 meters (or 7,218.2 feet). Larch is thriving splendidly on calcareous and sandy loam, especially on well shaded slopes. Larch avoids wet, sunny, and such localities which are exposed to rough winds.

Scotch pine (*Pinus sylvestris*) is found in the Alps and in some dry and poor localities elsewhere. It is running up to an altitude as high as 1,200 meters (or 3,937.7 feet, in southern Tyrol even as high as 1,700 meters (or 5,577.7 feet), here attaining the size of a dwarf only. In the sandy plains of Galizia, Scotch pine shows a good growth and furnishes fine timber.

The black pine (*Pinus Austriaca*) is very scarce on the whole. On the south slopes of the Vienna mountains it

forms small forests. It is fond of the sunny side and of calcareous ground.

It is impossible to ascertain the value per acre of the state and fund forests. This value depends on the locality, on the means of transportation, on the condition of the lumber market, etc. Even an average figure giving an idea of the value of the said forests cannot be given. If the annual net yield per acre is taken as a basis for the valuation of our forests at a rate of 3 per cent, then the average value of the state and fund forests per acre will amount to \$8.91. It is likely to range between \$3.50 and \$20 per acre, according to the possible yield.

During the twenty years between 1874 and 1893 there was expended annually on an average:

I. For forestry proper, namely, forest utilization, transport of forest products, charcoal burning, maintenance of forestry buildings, silviculture, etc.	\$732,578.17
II. For agriculture, namely, expenses for administration and for maintaining buildings.....	9,675.45
III. For other branches, namely, for technological industries, for shooting grounds, fishing, timber yards, etc.	87,193.67
IV. For administration, including the salaries for all local officers, rangers, guards, etc., their traveling expenses, the expense of keeping up buildings used by these officers, etc.	418,499.05
V. For public expenses (taxes and charity expenses).	259,867.44
VI. Money refunded	756.13
VII. Extraordinary expenses (purchase of real estate, new buildings, new surveys, demarkation of boundary lines, forest working plans, prescriptive rights, etc.)	143,845.88
VIII. Administration at headquarters (expenses at the territorial offices and at the ministry of agriculture)	151,340.20
Grand total expense.....	<u>\$1,803,755.89</u>

During the same period—namely, during the twenty years between 1874 and 1893—the mean annual gross receipts amounted to:

I. From forestry (sale of fuel and timber, of charcoal, of minor forest produce, etc.)	\$1,727,805.73
II. From agriculture (rentals from land leased, etc.)	161,592.16
III. Technological industries (rents of buildings and establishments, rents from shooting and fishing licenses, rents from yards, etc.)	291,747.02
IV. Money refunded	6,524.15
V. Extraordinary revenue	19,492.24
Total receipts	<u>\$2,207,161.30</u>

To the latter figures there must be added the value of the prescriptive rights under which the inhabitants of certain villages have the privilege of taking timber, fuel, grass, etc., from the forest without refunding any money for such taking, estimated at.. 290,336.40

Therefore grand total gross receipts.....\$2,497,497.70

Deducting from this amount the expenses previously mentioned, there remains a net revenue of..... \$693,741.81

Thus the entire state and fund forests of the Austrian empire have netted on an average, during the above named period of twenty years, 26.8 cents per acre per year.

During the five years lying between 1887 and 1893 there were planted up annually on an average 15,614 acres, by means of planting seeds or planting seedlings, at an expense of \$28,586.01 for labor only. To these planting expenses there must be added the annual expenses incurred for the following items, namely:

I. For raising, transplanting and nursing plants in nurseries proper	\$17,894.78
II. For preparatory work, as drainage, subsoiling, making mounds to plant upon, etc	1,694.96
III. For cleaning and attending to the young forest previous to the age of, say, 20 years	6,406.72
IV. Spades, picks, mattocks and other tools	834.02

Adding these items to the above named figure of \$28,586.01, the grand total expense for replanting amounts to \$55,416.49, or to \$3.55 per acre.

Of the entire forest area of 2,590,182 acres, six-tenths of one per cent are planted up annually. Of these, 40.5 per cent were planted with seeds and 59.5 per cent were planted with seedling plants. For planting seeds there were used annually 23,669 kilograms of coniferous seeds; further, 561 hectoliters of acorns and 10,543 hectoliters of walnuts. The number of seedlings planted annually averages 17,604,196, planted out on 9,294 acres.

Regeneration is effected partly from self-sown seed under the cover of mother trees, partly from coppice shoots, partly by planting and sowing after clear cuttings as indicated above. Besides, where natural regeneration fails, planting seeds or seedlings takes place. The number of acres either wholly or partly cut over annually is 18,212. Of these, 55 per cent, or 10,108 acres, are planted up artificially by means of sowing and planting, whereas 45 per cent, or 8,104 acres, are regenerated from self-sown seed or from coppice shoots.

The difference between the area planted up annually, namely, 15,614 acres, with the area replanted annually after a clear cutting just mentioned, namely, 10,108 acres, amounts to 5,506 acres, and may be explained partly from the fact that on a considerable fraction of the 8,104 acres just mentioned artificial help is needed when natural regeneration fails, partly from afforestation of areas not occupied by forest crops heretofore.

The total amount of the annual harvest, or annual cut, on the whole area under the state forest management is pretty constant, whilst it is more or less subject to changes in the different territories or forest ranges, according to market conditions. Owing to the system of roads and railroads in the forest of Galizia and of the Bukowina be-

ing extended annually, the annual utilization of forest produce in the state and fund forests is expected to increase in the future. The annual cut depends on figures prescribed by forest-working plans. It is never allowed to surpass the yield capacity of the forest.

Aside from charcoal burning, forest products are sold before manufacturing takes place. The trees to be cut are felled, freed from branches, and cut up into logs, and, if so desired, split up and freed from bark at the expense of the owner of the forest. "Timber" consists of: (1) Timber fit for building purposes which is not cut up into logs; (2) saw logs, the length of which depends more on the conditions of the logs than the inspection rules; (3) "work wood," which means timbers fit for carriage work, for turnery, etc.; (4) split timber, used especially for cooperage purposes. "Fuel" consists of wood for burning and for charcoal making. The former is cut up into pieces one meter (or 3.281 feet) long, the bark not being removed. According to the diameter of the log from which the fuel is taken, it is sold either split or unsplit. It is piled up according to quality, in distinct and separate piles. Fuel for charcoal burning is cut into pieces two or three meters long.

Relative to the reforestation of ground allotted to forestry, the main rules are found in paragraphs 2, 3 and 4 of the imperial "Patent," dated Dec. 3, 1852, which run as follows: Paragraph 2: "Without special permission, no forest ground must be devoted to other purposes than timber production. If forest ground is used for other purposes than timber production, the owner shall be fined 30 cents to \$1.50 per acre. After such unlawful use the ground must be replanted within a time prescribed by the local authorities. If reforestation does not take place within the time thus prescribed a second punishment shall take place." Paragraph 3: "Areas cleared from forests are to be planted

up with timber species within five years after the clear cutting in the case of forests owned by the state or by the communities. Wherever there are clearings left from olden times they must be planted up within a period equal to the time fixed for the rotation of crops or fixed as the age of maturity of trees. In the case of private forests, a longer space may be allowed according to circumstances. Whosoever neglects this prescription shall be punished in the same way as if he had used forest ground for other purposes than for timber production." Paragraph 4: "No forest must be devastated; i. e., it must not be treated in such a way as might endanger or render impossible the continuation of timber production. If there is such danger, the fine to be imposed upon the owner of the land shall be the same as if forest ground was used for other purposes than timber production, or as if afforestation was omitted after a clear cutting. Aside from the fine, afforestation shall be made by force, if necessary, the owner bearing the expenses."

If the treatment was such as to render timber production impossible for the future, a fine up to \$3 per acre shall be imposed upon the owner. Under these rules or laws the local authorities have planted up during the years 1891 to 1895:

In state and fund forests, 231 acres; in communal forests, 28,269 acres; in private forests, 126,949 acres.

Preventives against forest devastation were taken:

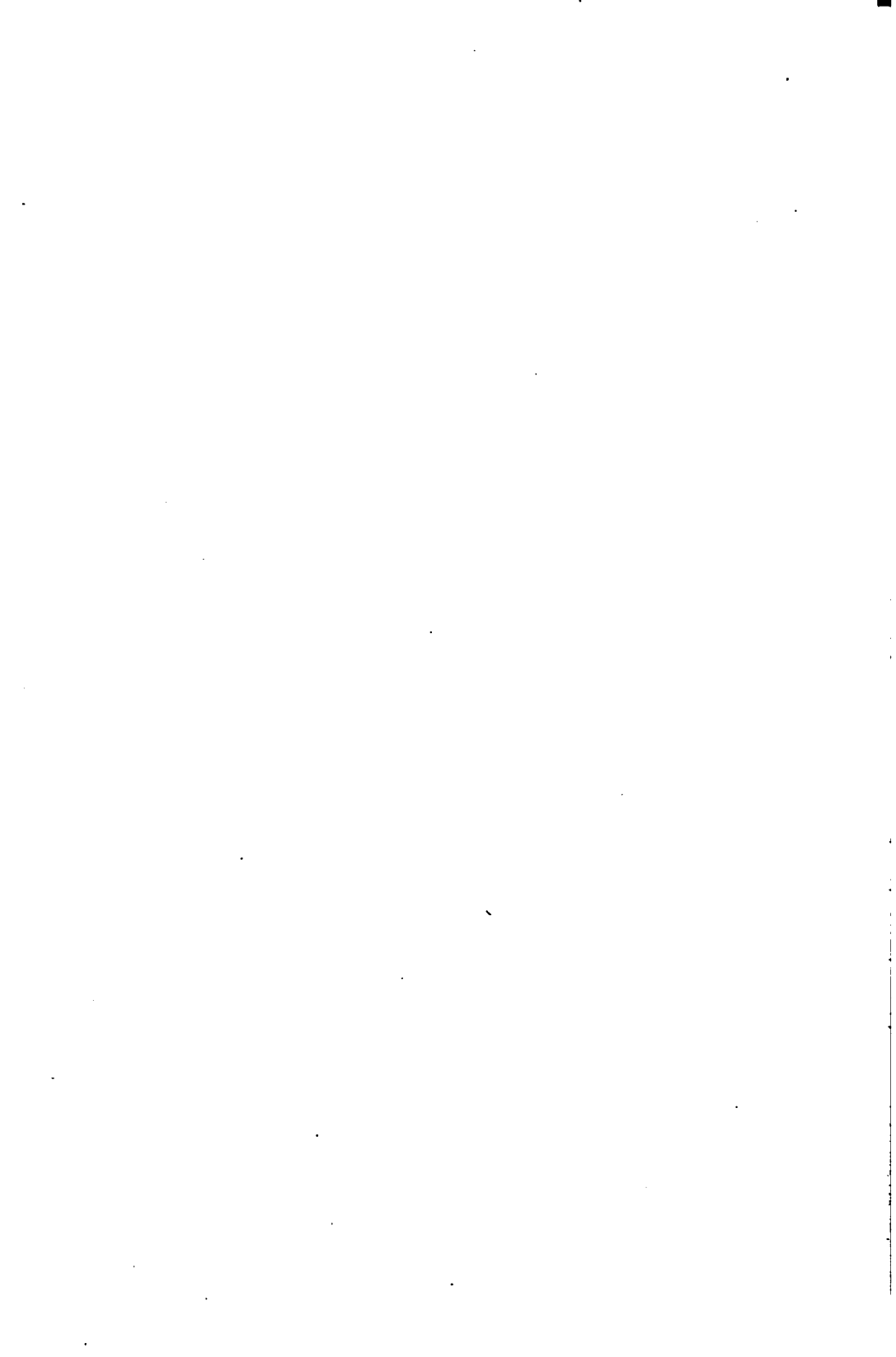
In state and fund forests, on 1,393 acres; in communal forests, on 328,487 acres; in private forests, on 1,003,342 acres.

The statistics for the years 1891 to 1895 show that there occurred 3,007 forest fires, running over an area of 19,310 acres, and causing a loss of \$163,904. On the yearly average, 601 forest fires have run over an area of 3,862 acres, involving \$32,781 damage.

These fires were caused: By carelessness, in 1,210 cases; intentionally, in 181 cases; by sparks from locomotives, in 118 cases; by lightning, in 26 cases; by unknown agents, in 1,472 cases.

The officers of the state forest administration have a general rank equal to all technical branches of government administration. The forest officers in Austria are divided into two groups, one of which is attending to the administration of the Austrian state and fund forests, while the other is charged with the control and enforcement of all laws and rules enacted with reference to forestry. The latter forest officers are joined to the local political administration.

All government officers are allotted to different grades or ranks, the rank depending on their merit and their age, and being combined with a certain title and with a definite income peculiar to that rank. Forest officers are found in the following ranks: Tenth rank, forest assistants engaged in the administration of state and fund forests, drawing a salary of \$364 to \$405 per annum, to which there must be added an additional pay varying from \$64 to \$162, according to the time which the officer has spent in government service; ninth rank, head foresters entrusted with the local administration, drawing a salary of \$445 to \$526, with an additional pay varying from \$81 to \$202; eighth rank, a forest master, or inspecting officer, draws a salary of \$567 up to \$729 and an addition from \$97 to \$243; seventh rank, a forest counselor draws a salary of from \$810 to \$972 and an additional pay of from \$142 to \$283; sixth rank, a superior forest counselor draws a salary of from \$1,134 to \$1,458, in addition to a pay of from \$162 to \$324, depending on time of service. The traveling expenses, daily allowances on journeys, etc., differ according to the rank of the officer. Many of the local officers are living in government build-





General view of Pelican lake. Indian in canoe. Photographed Aug. 17, 1904, for the annual report of the Chief (Forest) Fire Warden of Minnesota.

ings, paying a rent equal to one-half of the additional pay above mentioned.

PRIVATE FORESTS.

At the close of 1895 the entire forest area of Austria was 23,993,442 acres. Deducting from this figure the area of the state and fund forests, aggregating 3,782,369 acres (out of which 862,236 were unproductive area), there remain 20,211,072 acres, which are composed of communal forests to the extent of 3,456,782 acres, and private forests to the extent of 16,754,290 acres.

There are treated according to forestry principles proper: In the case of communal forests, 14.5 per cent, equal to 500,818 acres; in the case of private forests, 38.4 per cent, equal to 6,434,070 acres. In these forests all work is done according to working plans, periodically made by officers of a training equal to that of the government forestry officers. In 85.6 per cent of the communal forests (2,955,964 acres) and in 61.6 per cent of the private forests (10,320,220 acres) no working plans exist. The work is done without reference to scientific forestry, more or less at haphazard after empirical rules.

The price of private forests depends on the quality of the soil, the age of the forest, and on the locality, viz., on the market conditions and on the industrial development of the section in which the forest is situated. Thus it is impossible to give even an approximately correct figure representing the value of private forests. Forest land has been sold actually at prices ranging between \$5 and \$340.

The annual net revenue drawn from forestry varies just as much as the value of the forest itself. It is impossible to give any exact figure showing the annual net revenue from private or communal forests. A net revenue of equal to two or three per cent of the capital invested in forestry may represent a fair average.

The annual production of timber and fuel in the Austrian forests has somewhat declined of late. Savings are made everywhere to make good former over-cutting. Besides, the regulations of the forest laws are now being enforced, and under these enforced laws the utilization of forest produce had to be diminished. In the year 1890 the total harvest of timber and fuel from 24,173,333 acres of forest aggregated 29,341,590 cubic meters, or 1,035,758,127 cubic feet. In the year 1895, on the other hand, there were cut from 23,993,442 acres only 27,523,241 cubic meters, or 971,570,407.3 cubic feet.

It may be stated that the smaller figures, representing the area of the forest in 1895, are explained by the fact that the political authorities, whenever they think it fit, after consulting the foresters in charge, approve of a change of forest land into agricultural or pasture land. Besides, the diminished area is partly explained by mistakes made formerly in the survey of the forests.

DUCHY OF BADEN.

STATE FORESTS.

The aggregate extent of the state forests of Baden is 240,304 acres, located in the Black Forest and the upper valley of the Rhine. The prevailing kind of trees is coniferous. The beech, however, covers the largest surface; next follows the fir, then the silver fir and the Scotch fir. The average estimated value per acre, taking the average of the ten years, 1886-1895, is \$98.55. The annual aggregate expense of administration is \$568,078. The annual aggregate revenue amounts to \$1,235,332, and the net revenue is \$667,244. Number of acres annually sown to forest is 222, and the number of acres planted is 823. Reforesting is effected by seed from standing trees; also by planting trees; in some rare cases

by artificial sowing, the latter in the case of firs. There is a gradual increase of crop. The usual method of cutting the crop consists in cutting the mature trees and covers at periods, as a rule, from thirty to forty years, with longer or shorter intervals. Cutting in blocks clean (pines and Scotch firs) in exposed stormy situations is less frequent. According to paragraph 29 of the forest law of Baden of the year 1879, no part of any forest is allowed to be kept uncultivated. The number of forest fires during the years 1879-1888 was 61, the damaged surface 99 acres, and the damages amounted to \$2,225. The principal causes of such fires are negligence, when burning down the skirts of the forest, or by throwing away matches or stubs of cigars. Very few cases of fires are caused by railroad locomotives.

The forest service ranks equally with other branches of the public service, and is comprised in Class D of the tariff of salaries. Seven members of the Administration of Domains (which forms a part of the Treasury Department) are the highest forest officers. They bear the title of Councillors of the Forest Board, and have a salary not exceeding \$1,380, and \$147 compensation for rent.

Besides the state forest there are community and corporation forests, covering a total surface of 555,069 acres, which are managed on the same principles as the state forests.

PRIVATE FORESTS.

The aggregate extent of the private forests is 451,670 acres. About one-third of all private forests is managed on forestry principles, including the forests of the Public Administration of Street, River and Railway Construction, and the most extensive and important private proprietors. The total forest product of the country increases gradually.

BAVARIA.

STATE FORESTS.

Bavaria, whose attractive capital, Munich, is frequented by so many Americans, has 6,000,000 inhabitants. Its state forests comprise 2,150,000 acres, and are mostly managed as "selection" forests. Large forests are to be found in all parts of the kingdom; but as a general rule the mountainous districts in the south (Alps), the north (Spessart) and northeast (Bohemian forest) are covered with the densest forest. Of the whole area of the country 33 per cent is covered with forest. The prevailing kind of trees, or 77 per cent, are coniferous. The remainder comprise various kinds of deciduous trees—those losing their foliage in winter. Among the conifers, red and white pine are most frequent. Among the deciduous trees the beech occupies the greatest space. The oak is also cultivated quite extensively for tanning purposes. The average estimated value of the forest land is \$50 per acre. The annual aggregate expense of administering the forests (1891) including salaries of officials, wages of workingmen, local taxation, new purchases, etc., amounts to \$4,965,204. The total revenue from the forests the same year amounted to \$8,187,349. Number of acres sown or planted to forests in 1892 was 14,800, more than three-fourths of which area was planted with coniferous trees. In the case of the red pine and the white pine, reforestation is mainly done in the natural way. In the case of the fir (*pinus sylvestris*) it is always effected artificially; in the case of the beech, always in a natural way (seed from standing trees); in the case of the oak, generally by artificial sowing. There is a continuity of forest products and a steady increase of the revenue which the state derives from its forests. This is due, first to an increase of prices, secondly to an increase of the yearly

crop. The latter must chiefly be regarded as a result of the present condition of the forests, which are being and have been steadily improved; also of the economy which was practiced in former times. Where reforestation is effected by seeding from the standing trees, the crop is generally cut in lengthy strips, usually not exceeding about thirty yards in width. As a general rule the administration of the state forests makes it a principle to avoid cutting in large blocks clean. In regard to compulsory tree planting, it may be said that every forest area, the trees of which have been cut, no matter whether state or private property, must be reforested in a short time, unless evidence can be furnished that the land would be better adapted to agricultural purposes.

The damage caused by forest fires is quite insignificant, being in 1890 only \$974, in 1894 only \$1,686. The principal cause of such fires is the carelessness of the workmen employed in the forests and of individuals and parties making excursions, particularly on Sundays. There are no data at hand as to the number of such fires caused by railroad locomotives, and although some fires are no doubt so caused, the number is certainly very small.

The administration of the Bavarian state forests constitutes one of the departments of the ministry of finance. It is directly subordinate and responsible to the latter, no other authorities intervening. The highest forest official who may be regarded as being at the head of the forest administration, responsible, of course, as stated, to the minister of finance, bears the title "Ministerialrath,"—ministerial or cabinet councilor. The chief director of the Bavarian administration of state forests is "Ministerialrath" Ganghofer. His starting salary is 7,740 marks. After a sixteen years' service the salary advances to 8,820 marks. Next in rank are the so-called "Oberforstrathe," with a starting salary of 6,660 marks, which, after a sixteen years' service, is increased to 7,740 marks.

PRIVATE FORESTS.

The aggregate extent of private forests was 3,149,400 acres in 1892. In addition to the state and private forests there are about 800,000 acres of forests belonging to separate towns and villages. The forests which are owned by great landholders are managed on forestry principles. These forests, however, only comprise a very limited area, somewhat less than 400,000 acres. Most of the private forests are the property of small landholders. The average value per acre of private forests is somewhat less than that of the state forests. The net income rate varies widely. The data at hand are too few and too unreliable to admit of arriving at any conclusion with regard to the average. Opinions vary as to whether the total forest product of the country increases or decreases. In general the extent of the private forests seems to be somewhat decreasing. This would, of course, also appear to entail a decrease of the total forest product. Forest lands are only allowed to be changed into agricultural lands when proof can be furnished that the agricultural crop may be expected to exceed in value the forest crop. Between 1886 and 1891 7,000 to 8,000 acres of private forests were newly planted or sown.

DENMARK.

STATE FORESTS.

The experience of a country which had adopted important forestry regulations almost at the very beginning of the last century and which has successfully, through tree planting, resisted the invasion of desolating sand drifts from the sea shore must prove of much value. It was, therefore, with a high degree of satisfaction that I lately received from the Department of Agriculture of

Denmark, answers kindly furnished in the English language to some questions that I had submitted. I have put the information in its present form.

The aggregate extent of the state forests of Denmark is 142,140 acres, besides 2,962 acres for public parks. Of these, 67,700 acres are old forests, 74,440 acres are new plantations, especially on heathy tracts. The planting of forests had already commenced one hundred years ago, but has quite particularly increased since 1850. Forty-five per cent of the state forests are situated on the Danish islands; 54 per cent on the peninsula of Jutland, of which latter only 10.6 per cent are old forests, the rest are new heath plantations not yet thoroughly planted up. Beech comprises 37.7 per cent, oak 3.3, ash, maple, birch, elm and alder 4.8 per cent, and conifers 54.2 per cent. Conifers did not exist in Denmark 150 years ago, so that the extensive area of conifers in the state forests at present has been produced artificially. For the planting up of heaths the mountain pine (*pinus montana*) and the spruce (*picea excelsa*) are particularly utilized. The annual aggregate expense of administration averaged \$40,000 per year for the period 1893-97. Annual aggregate revenue averaged per year for the period 1893-97: revenue \$258,416, expenses \$195,370. The smallness of the net revenue arises partly from the fact that about half of the state forests are still so young as to yield only a small revenue, partly from extensive new areas being cultivated every year. The area annually sown or planted to forest averaged 2,285 acres per year for the period 1897-1900. Regeneration from self-sown seed is only used in the case of the beech (*fagus silvatica*) and of the silver fir (*abies pectinata*). In all other cases, forests are regenerated by means of planting plants or sowing seeds.

There is a sustained yield. Every tenth year a working plan is prepared for cuttings and cultivations of the next decennium. In working out these plans it is taken

into consideration, as far as may be, that there should be such areas and stocks of wood in store for the future as are available for the decennium. Within such a decennial period the yield of the cuttings varies according to circumstances; as a rule, however, there is but little differing one from the other. The extent of the state forests being on the increase, the proceeds will naturally increase. The forests are divided into parts of 10—100 acres in size, according to the nature of the soil or the species and age of the stock of wood. Within each decennial period a certain number of such divisions are destined for cutting, and the latter is commonly to be finished and the areas restocked with plants at the end of the period.

Private persons are prohibited by the law of September 27, 1805, from cutting away those remnants of the old forests of the country still existing in the said year. In cases of offence, means are placed in the hands of the government to force the owners to restock the cleared area under control of the state officer in charge. Consequently but very few forest areas have disappeared in the course of the nineteenth century. The many new plantations in Jutland which have risen by means of government subventions disbursed through the "Hedeselskabet," are subject to the same prohibition of clearing. Finally, under the guidance of a board of administration not appertaining to the state forestry service, the government has caused the waste sandy downs on the west coast of Jutland to be planted in order to subdue the sand drift in those parts, which had in former times caused great devastation. At the close of 1899 about 27,000 acres of sand downs had been planted with a good result. Damages by forest fires occur every year, but they have hitherto been rather insignificant. On account of the dense population of the country the casual forest fires are quickly quenched. The principal cause of such fires is care-





Rocky country a little south of Elephant Lake, township 66, range 19. Photographed Aug. 15, 1904, for the annual report of the Chief
(Forest) Fire Warden of Minnesota.

lessness of various kinds. It is notorious that several forest fires have been caused by sparks from locomotives, but no number can be stated.

The administration of the state forests is under the Department of Agriculture; its yearly budget is voted under the general budget of finances and its officers are appointed by the king. The state forestry is managed by three forest masters, twenty-three superior foresters, sixty-nine foresters and 306 keepers. The superior foresters have the use of a house free of charge, together with a lot of arable land (30-100 acres) upon which they pay the ordinary taxes, besides a salary of \$950-\$1,250. The salary of the forest masters is \$1,450, to which is added an allowance for traveling and other lawful expenses. The three forest masters give in an annual report on the operations of the local ranges under their supervision. Three reports are prepared in the department and printed in a condensed form as a supplement to the public accounts. Every tenth year is issued a review of the state forestry in the past decennium. The "Tidskrift Skovvasen" (forestry periodical), published in Copenhagen by Mr. C. V. Prytz, professor of forestry in the Royal Agricultural and Forestry Academy, and "Hedeselskabets Tidskrift" (periodical of the society for the cultivation of heaths), published by "Det danske Hedeselskab" at Aarhus, are the periodicals. The revision of the decennial working plans for state forestry, which is simultaneous with the preparation of the working plan for the next ten years, is undertaken by a "Skovtaxator" (appraiser of forests), classed directly under the department, and four assistant clerks. A second "Skovtaxator" with one clerk is constantly occupied in the experimental line, in examinations of the growth of trees and the economy of divers modes of forest husbanding, altogether in support of practical forestry.

PRIVATE FORESTS.

The aggregate extent of private forests is 505,900 acres, of which, by the statistics of 1896, beech (*fagus silvatica*) comprises 44 per cent; oak, ash, maple, birch and alder comprise 18 per cent, and spruce (*picea excelsa*), pine (*pinus sylvestris* and *montana*), silver fir (*abies pectinata*), larch (*larix Europea*), etc., 38 per cent. Three-fourths to four-fifths of these forests are managed on forestry principles. The extent of private forests by the official statistics was, in 1888, 414,837 acres, and, in 1896, 454,874 acres. By the law of September 27, 1805, before mentioned, and which is still in force, private persons are prohibited from cutting their parts of the old forests of the country standing at that time, aggregating at that date an area of about 280,000 acres. This area comprises (besides the old forest area of the state, about 100,000 acres) the remnants of the original forests of the country still existing. Since 1850 very considerable areas have been planted with forests, both by the state and by private persons, especially in the heathy tracts of the peninsula of Jutland. In these tracts an area of 108,500 acres has, since 1868, been planted by private persons, however under the guidance and control of the "Hedeslskab" (society for the cultivation of heaths), which is aided by the state (for the year 1900 to the extent of \$73,000); and of the above area 54,600 acres were thoroughly cultivated at the close of 1898.

FRANCE.

The total extent of the forests of France (exclusive of the colonies) is about 23,500,000 acres, which represents about 17 per cent of the surface of the entire territory.

These forests are divided in: Forests of the state, 2,700,000 acres; forests of the municipalities and of the public

institutions, 4,700,000 acres; forests of individuals, 16,100,000 acres. The forests of the state and those of the municipalities and of the public institutions are managed and supervised by the Administration of Forests. France only extends over 9 degrees in latitude, but, as it has very high chains of mountains, the result is that it possesses all the climates of Europe, from the hottest to the coldest, and that a great variety exists in the species of trees that compose the forests.

The principal varieties of these species are: In the warm region, comprising the borders of the Mediterranean sea and of the Gulf of Gascony, the cork oak (*quercus suber*), the evergreen oak (*quercus ilex*), the cluster pine (*pinus pinaster*) and the Aleppo pine (*pinus halepensis*).

In the temperate region, comprising the plains, the rolling grounds and the lower parts of the mountains, the common European oak (*quercus ruber*), the European white oak (*quercus pedunculata*), the beech (*fagus silvatica*), the hornbeam (*carpinus betulus*), the common European ash (*fraxinus excelsior*).

In the cold region, comprising the middle and upper parts of the mountains, up to the extreme limit of vegetation, the silver fir (*abies pectinata*), the Norway spruce fir (*abies excelsa*), the beech (*fagus silvatica*), the Scotch pine (*pinus sylvestris*), the mountain pine (*pinus montana*), the larch (*larix Europea*).

STATE FORESTS.

The total area of the forests of the state, 2,700,000 acres, is composed of 2,100,000 acres of productive forests and of 600,000 acres of protective forests, situated in the mountains or on the dunes of the ocean; of lands recently purchased by the state on the banks of torrents and whereon timber is now being planted.

The forests yield annually to the state:

Timber (cubic feet)	33,800,000
Fire wood (cubic feet)	62,300,000
Total	96,100,000

This represents nearly an annual production of 46 cubic feet of wood per acre of productive forest. The state forests produce in addition thereto oak bark, which is used in the tanning of leather; cork, rosin and several other small products; also hunting rights are leased.

The gross annual income in money is \$5,500,000, or \$2.62 per acre of producing forest. In some forests this average is largely exceeded and it attains as high as \$8 per acre.

The expenses are as follows, viz.:

Labor	\$1,240,000
Forest instruction	35,000
Sundry works	360,000
Reforestation of mountains	700,000
Taxes paid to departments and municipalities	360,000
Sundry expenses	60,000
Total	\$2,755,000

But of all these expenses a large share is applied either in administering the forests of the municipalities or in executing works of real public utility in the "protection forests," or in reforestation mountain lands (to prevent slides and the like). If we make these several deductions we find that the expenses incurred in the producing forests do not exceed \$1,500,000 or 71 cents per acre. The net annual income of these forests is therefore \$2.62 less 71 cents, equal to \$1.91 per acre.

The state forests are carried on either as high forest or as coppice, and are managed under regulations made by the President of the Republic. Cuttings are made yearly. In forests rich in wood there is cut every year an amount equal to the increment or growth; in forests poor in wood

they cut less than the increment in order to gradually increase the forest. The endeavor is made also to increase the production of the timber wood by reducing that of the fire wood. The "high tree forests" are cut down at periods ranging from 120 to 150 years.

The work is directed in a way that will insure natural reforestation from the seeds that fall from the standing trees. Not only the trees that have attained the age determined by the rules are cut down, but also the dead ones and those which are dying, and those that prevent the growth of neighboring trees. In temperate climate the annual cutting of high trees is on a limited area; a large number of trees are cut down simultaneously. In very cold climates and where winds are to be feared, only a few trees are taken away at a time on the same point, and cutting is then done on a larger area.

The low forest, coppice and second growth are cut in rotations, ranging from 25 to 35 years. The reserved trees, which are very numerous, are cut on an average every 100 years, but some selected trees are allowed to attain and even pass 200 years.

The labor performed in the forests consists in the construction and maintenance of forest roads, water saw-mills, houses for watchmen, replanting. Fortunately, owing to the system of culture now in use, artificial reforestation has but little importance in forests, properly speaking, but sowing and planting in the small open spaces, or on the points where a few more valuable species are to be introduced, or where the soil of the forest is better adapted to some varieties, there sowing and planting are more frequent. The average cost of such work is \$10.00 per acre.

Very considerable reforestation is made on mountain lands, where the state plants trees to regulate the action of the waters and stop the ravages of torrents. For that purpose \$700,000 are expended every year, the

largest part of which is used in the purchase of land, and the other part in dams to regulate the streams, and in plantations to settle and retain the soil. The state purchases yearly, on an average, 16,000 acres. The average cost of reforestation is \$20 per acre, and \$18 must be added thereto for work in improving the streams, building roads, etc. Planting is preferred to sowing on calcareous or chalky soil.

The administration of the forests forms part of the Department of Agriculture. It has charge not only of the direction and care of the forests of the state and of those belonging to municipal corporations and public institutions, but also the overseeing of the fishing in the rivers and creeks. At its head is a director, residing in Paris, who has under him: A central service composed of 3 administering general inspectors, 10 inspectors, 5 assistant inspectors and 17 clerks.

An exterior service composed of:

First—Personnel superior or of administration—32 forest keepers, 200 inspectors, 215 assistant inspectors, 250 general wardens.

Second—Personnel inferior or of surveillance—3,500 foremen and wardens, paid by the state; 3,700 foremen and wardens, paid by the municipal corporations and public institutions.

The annual salaries paid are as follows:

SUPERIOR OFFICIALS.

Director.....	\$3,000
Administrators.....	1,800 to 2,600
Forest keepers.....	1,600 to 2,400
Inspectors.....	800 to 1,200
Assistant inspectors	600 to 800
General wardens	300 to 520

Exclusive of some additional allowances for traveling expenses.

INFERIOR OFFICIALS.

Foremen and wardens paid by the state an average of ..	\$160.00
Foremen and wardens paid by the municipal corporations and public institutions	116.00

The foremen and wardens receive in addition thereto allowances of firewood, tillable land, pasture grounds, etc.

Those in the employment of the state have free rent in houses built in the forest, or in lieu thereof they receive as compensation a cash equivalent.

The superior officials are entitled to a retreat pension at the age of 60 years, and the inferior officials at the age of 55 years.

France has three forestry schools. One school of higher instruction at Nancy; one school of secondary instruction, and one school of primary instruction. The two latter schools are established in the department of Loiret, on the possessions of the administration at Barres.

FORESTS OF MUNICIPAL CORPORATIONS AND OF PUBLIC INSTITUTIONS.

The forests of municipal corporations and of public institutions comprise 4,700,000 acres. They are supervised by the Forest Service on the same conditions and according to the same principles as the state forests. They contain about 200,000 acres of forests for protection, and their producing area is thereby reduced to 4,500,000 acres. They produce annually, timber, 42,000,000 cubic feet; fire wood, 128,000,000 cubic feet, and together, 170,000,000 cubic feet. This represents nearly an annual production in wood of 38 cubic feet per acre of productive forest. The annual cash value of the product, including the bark, cork and rosin, is \$6,400,000, or \$1.42 gross income per acre. The net income is about \$1.14 per acre. The forests belonging to the municipalities and public institutions are under regulations approved by the president of the republic. These regulations and those of the state

forests have been established with a view of insuring a continuous annual production and even of increasing that production in the forests where it is not yet sufficient.

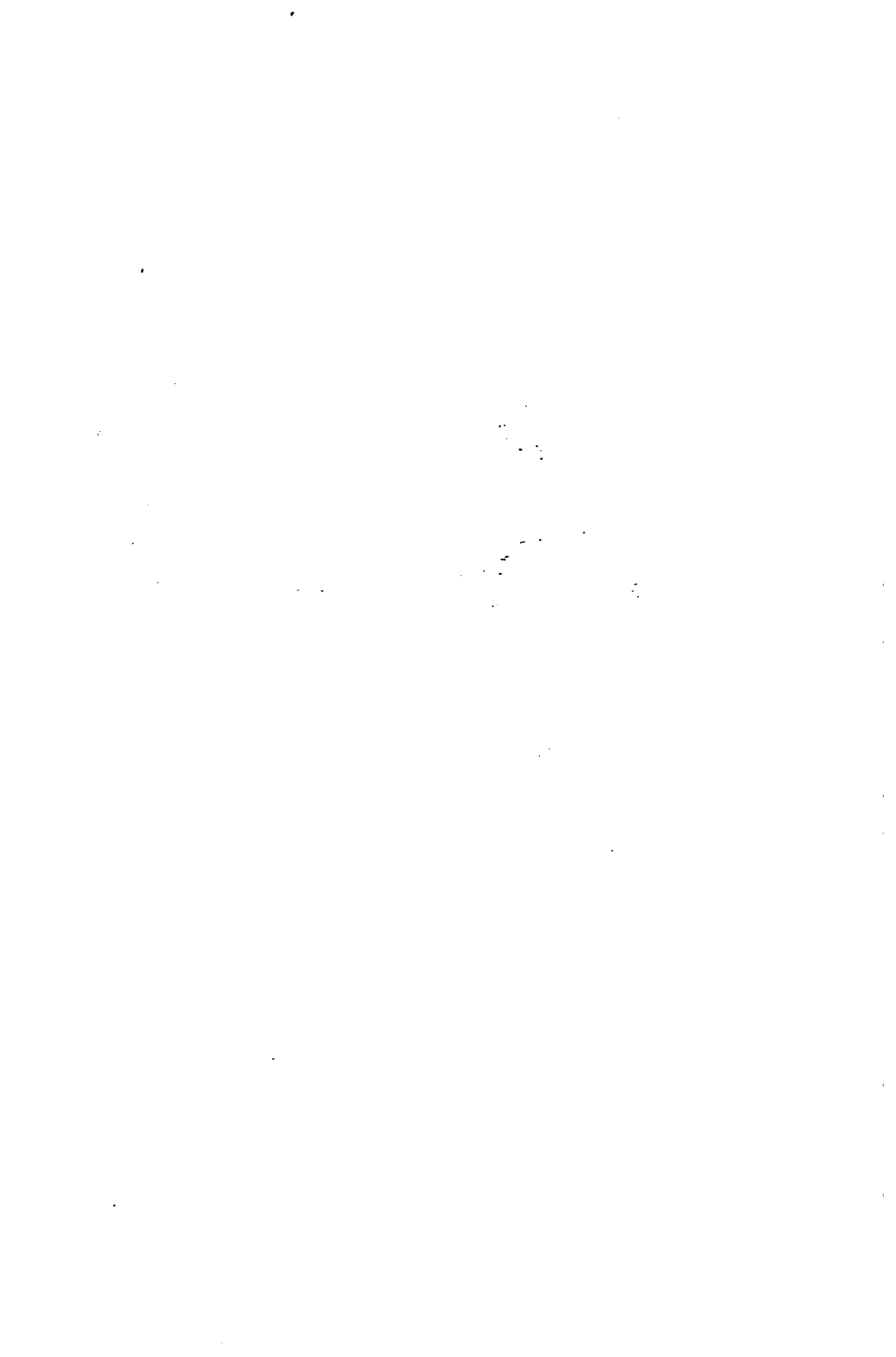
PRIVATE FORESTS.

Private individuals are at liberty to manage their forests as they please. But they are prohibited from cutting and taking trees from forests which are necessary to maintain and regulate water flow, to protect lands against the encroachments of the sea and sands, to defend the territory, or which are necessary for the public health. The destruction of private forests has become rarer and rarer and the proprietors acknowledge now that on soils of poor quality the income from forests is greater than that from arable land. As a result the area of private forests, instead of decreasing, increases from year to year by reason of the timbering of lands on which agriculture pays but small profits.

The income from private forests in quantity and in money is not exactly known. It is, however, known that on the same area they pay less than the state forests. Private individuals in their anxiety to get returns are inclined to cut down the wood when it is too young, and in the forests where coppice wood is raised they do not leave a sufficient reserve, and oftentimes leave none at all. One can notice, however, that the principles of silviculture are spreading more and more in the culture of private forests. The large forests are subjected to the same mode of management and are treated like the state or municipal forests. On the whole the annual production is regular and tends to become better in both quantity and quality.

FOREST FIRES.

In the temperate and in the cold regions of France (that is, in the larger portion of the territory) the fires are but few and cause slight damage. The long periods of



drought are not frequent, the numerous roads that run through the forests make very good lines of defense, and the villages that surround the massive wooded areas furnish at the first alarm devoted laborers. The railroad companies, being held responsible for damage by fire caused by flying sparks from their locomotives, take particular care, and in exposed places cut the grass and brush along their roadbeds.

The forestry code forbids, under penalty of \$4 to \$20, carrying or lighting matches in or within a distance of 200 metres from the forests.

In the forest camps of the state, municipal corporations or public institutions, it is forbidden to the workers to light fire outside of the buildings or shops, the location whereof is indicated by the forest service.

In the warm region the dangers from fires are greater. As a preventative against them more roads are built, trenches 20 to 50 metres wide and kept free from grass and brush are made around the forest, along railroad lines, on the dividing lines between forests belonging to several owners, and also from distance to distance in the large and dense forests belonging to the same proprietor. The use of fire in forest camps and in agricultural camps situated within 200 meters from the forests is forbidden during the months of June, July, August and September. A special watch is organized, and telegraphic lines penetrating the center of the forests admit of alarm of fire at its start and call for help. If the working force appears to be insufficient the military authority furnishes the deficiency and sends on the spot soldiers who act according to the directions of the forest service.

COLONIES.

France, fully convinced that the preservation of forests is in all lands of the highest importance, has organized a forest service in its possessions outside of Europe—in Al-

geria, Tunis, Madagascar, Indo-China, Reunion. In Algeria the organization is exactly similar to that of France, and calls for an annual expenditure for salaries and works of \$600,000.

HESSE-DARMSTADT.

STATE FORESTS.

The state forests of the Grand Duchy of Hesse-Darmstadt occupy 165,000 acres, and are situated in the Rhine valley (on alluvial sand), in the Vogelsberg mountains (on basalt and red sandstone), and in the Odenwald mountains (on granite, syenite and red sandstone). The prevailing species are beech, occupying 40 per cent, Scotch pine, occupying 34 per cent, and oak, occupying 16 per cent of the area under forest; whilst the remaining 10 per cent consist of spruce, fir, larch, alder and birch forest. It is a noteworthy fact, proved from the writings of Cæsar, Tacitus and of early German authors, that there were no coniferous trees present in their time except yew. Pine was introduced only from the 15th century on. The average value per acre is about \$100; but there are great differences according to quality of soil, transportation facilities and density of population. The annual aggregate expense of administration is \$148,500; and the annual aggregate revenue is \$561,000. There are planted annually to forest 750 acres, the planting extending over the entire surface of the ground. On 2,500 acres, according as "blanks" in natural regenerations are stocked, partial planting takes place. There are used on an average per annum: 110,000 pounds of seeds of broad leaved species; 4,000 pounds of seeds of coniferous species; 5,000,000 broad leaved seedlings; 5,000,000 coniferous seedlings. The annual expense for starting new generations of trees

aggregates \$22,000. Beech is invariably raised from the seed dropping from mother trees evenly distributed. Scotch pine is planted when one year old, over 10,000 seedlings being used for each acre. Spruce and fir are planted when four years old, or seeds are sown in strips being about four feet apart. Oak is either planted as a seedling two feet to three feet high, or acorns are dibbed in, the method used depending on local conditions. All plants are raised in forest nurseries, kept under the care of local forest rangers. Comparatively large areas are covered with oak-coppice forest, which is copped every 15 to 20 years, with a view of obtaining tanning bark. White pine and douglas fir have been introduced with splendid success. American red oak and hickory seem to answer the local conditions fairly well.

In certain densely populated sections, where soil fit for agriculture is scarce, field crops (potatoes and rye) are raised together with tree crops during the first three to five years following the cutting of mature trees. Rows of potatoes alternating with rows of pine seedlings are frequently seen. This combination reduces the expense of reforestation. It secures for the seedlings a soil of high porosity, whilst it exhausts, on the other hand, the mineral contents of the ground and the accumulated layer of humus.

Reforestation is effected on about 40 per cent of area by seed from standing trees; on about 10 per cent of area by coppicing and on about 50 per cent of area by artificial sowing and planting. The annual yield is strictly sustained. The yield per acre per annum is 74 cubic feet, of which not less than 60 cubic feet is used as fuel. The value of cordwood piled up along forest roads is about \$2.50 per cord. The value of logs cut and hauled to forest roads is about \$11.25 per 1,000 feet board measure. As to the usual method of cutting a crop, about 30 per cent of the yield is made up of stuff obtained from thin-

nings. The remaining 70 per cent consists of mature trees. Wherever regeneration is effected from self-sown seed, the mature trees are gradually removed. Where planting is resorted to, a clean sweep is made of all mature trees over areas aggregating about 25 acres on an average. Large clearings are considered a mistake, as it is difficult to restock them.

With regard to compulsory reforestation the following may be said: Private forests must be planted up within three years after the removal of a mature crop. Exemptions from this rule may be granted, upon application, by the State Forestry Bureau. Waste land planted up by the owner is, once for all, exempted. If a forest owner hesitates to replant his clearings within three years after the cutting of the trees, he is subject to a fine. The forest authorities will replant the clearing at the owners' expense, the owner being allowed the choice of species. Any treatment of forests likely to result in permanent unfitness for the production of timber, is prohibited.

Little damage is done, generally speaking, by forest fires. On the average annually 54 fires are reported, running over 45 acres altogether, and resulting in an annual loss of \$533. In 28 cases out of 272 cases the forests were so badly damaged that it was considered wise to cut the trees and replant the area thus cleared. The principal cause of forest fires is carelessness of smokers. A few only of such fires are annually caused by railroad locomotives, perhaps three annually.

The rank of the forest officer corresponds entirely with the rank of officials in other branches of the public service. The average salary per year of the "Oberforstrat" is \$1,300, of the "Oberforstmeister" \$1,125, of the "Oberforster" \$825, and the office and transportation expenses of the last two named are \$350 and \$200 respectively. No official report is published, either annually or periodically.

PRIVATE FORESTS.

The extent of private forests is as follows: Communal forests, administered by state foresters, 235,000 acres; entailed forests, owned by families, 132,000 acres; ordinary private forests, owned by individuals, 70,000 acres; total, 437,000. All communal forests and all entailed forests are managed on forestry principles, furnishing a sustained yield. The condition of the ordinary private forests is deteriorating, as the productiveness of the soil is abused by pasture, removal of litter and incomplete density of leaf canopy. Communal and entailed forests are worth as much as state forests, namely, about \$100 per acre. The value of private forests owned by individuals is considerably less. The average rate of net income is about 2½ per cent. The total product of the country is well sustained.

Considerable sums are derived in state and communal forests from hunting and fishing leases. The foresters of all grades enforce, *ex-officio*, all fish and game laws. The subaltern foresters, as a general rule, are taken from the army.

The wages of the common laborer average about 50 cents per day. In the mountainous sections wood fuel is cheaper than coal. In the state forests \$24,700 are annually spent for new roads, or for macadamizing old roads. The state oberforster is at the same time the manager of all municipal or village forests lying within his district. The sale of forest produce, however, is done by the mayors of towns and villages. A splendid system of well graded public roads, covered with stone in the Telford system and maintained at an annual expense of \$270 per mile, facilitates economic forestry to a very high degree.

ITALY.

STATE FORESTS.

It was a peculiar pleasure to receive, as I lately did, from the Ministry of Agriculture at Rome, an account of the forestry of Italy, that beautiful country which dates back thousands of years and whose woods have been sung by Horace and Virgil. The aggregate area of the state forests is 128,960 acres, principally situated in Tuscany—provinces of Florence, Arezzo, Grosseto, Pisa and Leghorn; and Venice—provinces of Belluno, Treviso and Udine. These lands are regarded as inalienable. The prevailing kinds of trees are oak, beech, pine, larch and fir. The total annual expense of administration averages about \$80,000. The annual sale of the raw material from the state forests averages \$150,000. The number of acres annually reforested with trees is 150. The method of reforesting varies according to the different species of trees and the local conditions; but seeding, whether artificially or naturally, is used only for the oak and the beech. For other kinds, such as the fir, pine, larch and chestnut, reforesting is done by planting. Generally good care is taken to maintain a sustained yield. In regard to cutting, the practice is to cut only those trees which have reached fiscal maturity and those that are dead or about to die.

The damage caused by forest fires amounts to about \$80,000 a year. The causes are principally accidental. Only a very small number of forest fires are caused by railway locomotives. The forest service has much importance in the protection of mountainous land and in the control of water. The annual salary of the chief inspector of the forests of the first class is 6,000 lire; that of the chief inspector of forests of the second class, 5,000 lire; that of inspector of forests of first class, 4,000 lire.

The Minister of Agriculture generally publishes a detailed report on the administration of the forests every five or six years.

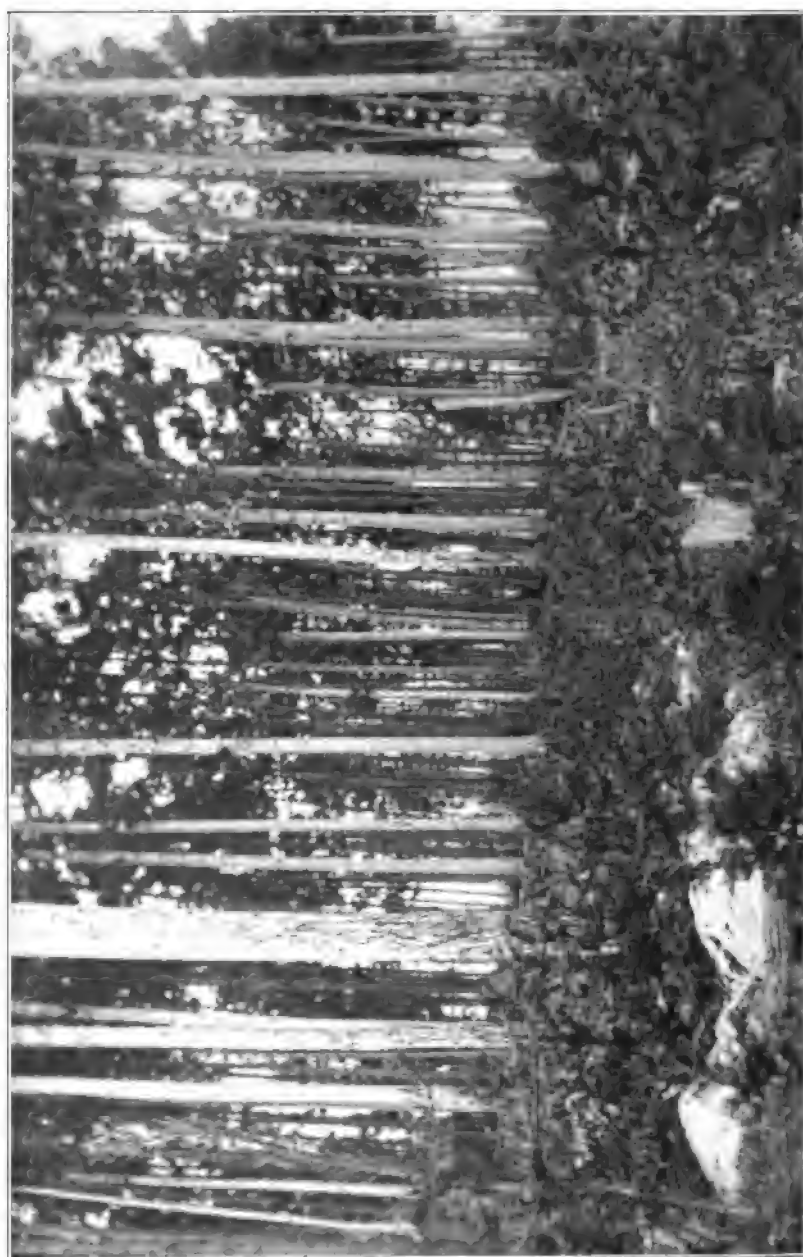
NORWAY.

STATE FORESTS.

The extent of the state and semi-public forests of Norway is 2,587,500 acres. Of these, 837,500 acres are located in the provinces of Tromsø and Finmark; 140,000 in that of Norrland; 285,000 in North Drontheim, and 225,000 acres in South Drontheim and Romsdal, and about 397,500 acres in Hedemarken. The prevailing kind of trees are pine (*pinus sylvestris* L.), spruce (*Abies excelsa* D. C.), and two species of birch. The average estimated value of the forest land is \$2.70 an acre. The annual aggregate expense of administration is about \$108,000, and the annual aggregate revenue varies from \$60,000 to \$67,500. The number of acres annually sown or planted to forest varies from 150 to 175 acres. Reforesting is almost entirely effected by natural seeding from standing trees, and, when artificial culture is employed, by planting trees. The crop of forest production is periodical, and depends partly on the market prices of lumber. The forest administration tries to prevent the yearly average yield exceeding the net increase of the forest. Cutting must in part depend on the demand. Where it does not pay to cut smaller trees, the mature ones are principally cut, while at the same time, as far as possible, diseased and injured trees, as well as such as would hinder in the growth, are removed. Where, on the other hand, trees of smaller size can be profitably sold, small blocks are cut clean in order better to promote new growth.

The law of July 20, 1893, on the preservation of "Protecting Forests" and against the destruction of forests, has special provisions relating to "Protecting Forests," by which are meant forests serving as a protection against snow avalanches, stone slips, alteration of river beds, shifting sand, or as a special protection to other forests or to inhabited country. "Protecting Forests" are also such as bound districts and mountain forests, which, from their situation on the slopes of high mountains or in the neighborhood of the sea, or in the far north, grow so slow that they would die out if neglected. Under "Protecting Forest Lands" are also included bare fields, to be planted in the future to serve as other "protecting forests." The municipal council selects three men, who, after consulting the public forest officer, propose the localities within the district to be considered as "protecting forests." The municipal council has then to fix the boundaries of the forests, and on the proposition of the forest inspector of the district to determine the rules for its management. These regulations must have the sanction of the king to be valid. The municipal council can also make reservations, subject to the king's approval, against the destruction of the forests in general. Such municipal regulations relating to "protecting forests" and forests in general may probably also include compulsory regulations as to planting and sowing of forests already cut down. No other laws relating to forest culture exist in Norway.

The damage caused by fires in the public forests is inconsiderable. Many years there is none; and the damage done to private forests is of small account and unreported. The principal cause or causes of such fires is carelessness of owners, fishermen, cowherds, etc., as well as the burning of heather for cultivation of the land. The law of July 14, 1893, on "Fires in Forest and Fields," with the supplemental law of July 27, 1896, has provisions relating to the prevention and extinction of forest fires.



Norway and white pine on rocky land, near head of Vermillion Lake. Photographed August 19, 1904, for the annual report of the Chief (Forester) Fire Warden of Minnesota.

The central administration of the forests is directly under the department of the interior, without intermediate officers. The service is under the charge of the chief (the director of the forests), and there are 4 forest inspectors, 25 forest officers, 1 forest engineer, 2 assistants, 7 forest planters and 363 forest guards. The yearly salary of the chief (the director) is \$1,450, without additions. The inspector's salary is \$800, increasing up to \$970. The forest officers, \$480, increasing to \$800. All these functionaries have their traveling expenses paid when traveling in the service of the state. The officers and the inspectors hand in every year a report to the director, who publishes a report on forest matters generally every third year. The only forest periodical in Norway at present is the "Tidsskrift for Skovbrug," (Periodical for Forestry), published by the Norwegian Association for Forestry.

PRIVATE FORESTS.

The aggregate extent of private forests is 18,000,000 acres, of which about 276,000 acres are managed on forestry principles. The average value per acre is from \$4.28 to \$5.36, and the average annual rate of net income is from 55 to 60 cents per acre. The cutting undoubtedly exceeds the natural increase of the forests. The supply of wood is consequently decreasing, and the size of the trees decreases. The government purchases annually forests to the amount in value of \$21,440. It has three large and several smaller nurseries. These supply the required number of plants to the public and to private parties. It has also four seed establishments, which supply the public and private demand for tree seeds. It also has two elementary schools of forestry, and it tries through its functionaries to instruct forest owners in rational management of the forests.

PRUSSIA.

STATE FORESTS.

The extent of the state forests of Prussia is 6,955,227 acres. Included in this, however, are 715,637 acres not designed for tree culture. In addition, the extent of forests belonging to municipalities is 2,563,812 acres; belonging to churches, 207,752 acres; belonging to corporations, 555,900 acres; private forests, 10,828,730 acres; making an aggregate extent of 21,111,421 acres in the whole kingdom.

The prevailing kinds of trees in the state forests are Scotch pine, larch, beech, red pine, fir and oak. The value of the land varies so much, rising from a small amount to \$700 per acre, that it is impossible to give an average estimated value. The annual aggregate expense of administration (state forests) is as follows: The office expenses and maintenance, including expense for education in forestry, etc., averaged in the years 1893 to 1897, per annum, \$8,500,000. The annual aggregate revenue in the years 1893 to 1897 amounted to \$17,200,000, being at the net rate of \$1.50 per acre of actual forest. The number of acres sown or planted with forest annually during the years 1893 to 1895 was 44,830.

The foresting of the beech is mostly effected from standing trees, though artificial sowing and planting are also done. The oak is either reforested by seed from standing trees, or artificially through sowing or by planting. The Scotch pine is first cut clean and reforested by sowing or planting, and the red pine the same. Sowing from standing trees is not common. In regard to the continuity of forests products, the forestry department endeavors to obtain the highest possible continuous net income. The usual method of cutting is in blocks clean.

Under the head of compulsory tree planting the following laws are referred to: The Forest Protection Law of

July 6th, 1875; the law of August 4th, 1876, concerning the administration of forests owned by municipalities and public institutions in the provinces of Prussia, Brandenburg, Pomerania, Posen, Silesia and Saxony.

The average annual damage caused by forest fires in the years 1892 to 1896 was as follows: Totally or mostly destroyed, 2,992 acres; only slightly damaged, 117 acres; only the surface destroyed, 522 acres. The average annual number of forest fires in the years 1892 to 1896 was 36, the causes of which were as follows: 12 unknown, 2 railroads, 5 incendiary, 16 caused by carelessness, 1 lightning. During the years 1892 to 1896 the annual average number of forest fires caused by railroad locomotives was 2.

The officers in the forest service are equal in rank to the other high grade officers in the government service. The foresters have clerical rank. The salary of "Oberforster" (district manager) ranges according to length of service from 2,700 to 5,700 marks. Unfavorably situated officers receive an additional amount, the maximum of which is 600 marks annually. In addition there is usually free residence and fuel. The salary of the "Oberforstmeister" (chief inspector) is from 4,200 to 7,200 marks, according to length of service, which is calculated from the time of qualification for the office of "Forstrath" (councillor). The "Oberforstmeister" and "Forstrath" are each allowed an amount not exceeding 2,900 marks for traveling expenses.

PRIVATE FORESTS.

The extent of private forests in Prussia, as above stated, is 10,828,780 acres. About one-half of these forests are managed on forestry principles, and their average value is somewhat less per acre than that of the state forest. On the larger estates the area devoted to forests gradually

increases, while on the smaller estates the forest area probably decreases.

Some of the forests of Prussia are attractive resorts for travelers, and especially pedestrians, who enjoy the excellent roads. Of the celebrated Thuringian chain, which is 70 miles in length by from 8 to 25 miles in breadth, a writer says: "The successive hills melt into each other in gentle undulations, forming a continuous and easily traced comb, and only the northwest slopes are precipitous, and seamed with winding gorges. This mountain range incloses many charming and romantic valleys and glens; the most prominent feature of its picturesque scenery is formed by the fine forests, chiefly of pines and firs, which clothe most of the hills."

Prussia comprises nearly two-thirds of the entire extent of the German Empire, yet its area lacks considerable of being twice that of Minnesota. Thirty-one per cent of its soil is predominantly sandy, and on the whole probably is not as good as that of Minnesota; yet it sustains a population twenty-five times as large as that of Minnesota. This fact might well find a lodgment in the minds of our statesmen, that whereas Prussia annually derives a net revenue of \$1.33 an acre from her 6,000,000 acres of state forest, our state, from about an equal area of land in its borders, adapted to forest, derives no regular net revenue at all.

DUCHY OF SAX-MEININGEN.

The area of state forests is 106,530 acres; of communal forests, 84,460 acres; of private forests, 71,850 acres; miscellaneous, 1,480 acres; in the aggregate, 264,310 acres, being equal to 42.4 per cent of the total area of the state. The state forests comprise 24 units of ad-

ministration, in charge of 24 superior forest officers. The highest functionary in forestry matters is the president of the forestry bureau. The bureau is composed of five forest counsellors, two of whom act as forest inspectors at the same time, each one supervising 12 of the above named 24 forest officers. The annual yield of the state forests is 5,779,669 cubic feet of lumber and fire-wood cut in ripe forests, and 1,288,904 cubic feet of fire-wood and pulp-wood obtained from thinnings. These figures correspond with an annual yield of about 155 feet board measure of lumber plus 0.40 cords of fire-wood per acre per annum. The state forest officers at the same time control the management of the communal and private forests within the state. All grades of forest officers have certain police duties concerning forests, fish and game preservation.

The municipalities owning forests are required to appoint well trained foresters for the management of their forest realties.

SAXONY.

STATE FOREST.

The aggregate area of the state forest is 432,000 acres. The forests are scattered over the Erz mountains themselves and over their outskirts. They are further situated in a few smaller and separate mountain ranges and in the plains. The altitude at which the state forests are found ranges from 100 to 1,200 meters, or from 328.1 feet to 3,937.2 feet, above sea level. The first group of forests, in the Erz mountains, is pretty compact and comprises 200,000 acres. The second group, in the outskirts of the Erz mountains and in some smaller distinct mountain ranges, comprises 136,000 acres; and the third group, in

the plains, comprises 96,000 acres. The soil consists of decomposed granite, granulite, gneis, mica-slate, clay-slate, grauwacke, porphyry, sandstone and some basalt. In the plains there is diluvium and alluvium. Only a very small portion of the forest area might be deemed fit for agricultural use.

The principal tree species are spruce, *picea excelsa* (Link); Scotch pine, *pinus silvestris* (L.); silver fir, *abies pectinata* (D. C.); larch, *larix europææ* (D. C.); roth-buche, *fagus silvatica* (L); oaks, *quercus pedunculata* (Ehrh.), and *qu. sessiliflora* (Sm.); hornbeam, *carpinus betulus* (L.); ash, *fraxinus* (L.); several maples, namely: *acer pseudoplatanus* (L), *A. platanoïdes* (L); further, several species of elm, *ulmus*; of birch, *betula*; and of linden, *tilia*. The prevailing species is spruce.

The value of the state forests, including timber and soil, aggregates \$76,490,000. Hence the value per acre is \$177. The annual expenses for administration for the year 1896 were \$1,040,000. In the year 1896 the annual gross revenue amounted to \$2,986,000; the annual net revenue to \$1,946,000.

The entire area planted annually varies according to circumstances. On the average it will reach 6,900 acres. Of these 6,900 acres 800 acres are planted up with seeds and 6,100 acres are planted up with plants. About 20 per cent of the above figure 6,900, or 1,380 acres, consist of blanks in plantations previously made where the original planting has failed. Thus it appears that the area planted for the first time after the removal of the old crop is only 5,520 acres. The question whether plants or seeds shall be employed for restocking cleared ground depends on the condition of the soil. As a general rule, seeds are planted only on such areas which do not produce grass and weeds to a large extent and which at the same time are of sufficient fertility and well protected against late frost. The sowing or planting of seeds must

be done not later than in the second year after the final removal of the former tree crop. Strips about three feet wide or places about six feet square are cultivated with a spade before the seed is thrown on them. Only in rare cases the entire area to be planted with seeds is ploughed and harrowed and the seeds spread over it broadcast. The plants used for planting up a clearing are as a rule two years old or older. The age of the plants selected depends on the condition of the area to be planted aside from depending on the species itself. Spruce, Scotch pine, fir and larch or tamarack, as a general rule, are used two to five years old; beech, oak, ash and maple, as a general rule, are used three to six years old. The plants are raised in nurseries. Only in rare cases they are taken from areas previously planted with seed in the open forest. The number of plants used per acre ranges between 600 and 4,000, according to the species, the size of the plants used and the condition of the area to be planted.

Regeneration from self-sown seed is only used in the case of the beech (*Fagus silvatica*). In all other cases forests are regenerated by means of planting plants or sowing seeds.

There is no law or rule in Saxony for compulsory reforestation after clearings.

There is not much damage done by forest fires. It averages \$300 per year. Forest fires of a larger extent have happened very rarely. As a rule, forest fires are caused by the careless use of matches by tobacco and cigar smokers. Very few fires are caused by sparks from locomotives; on the average perhaps three per year.

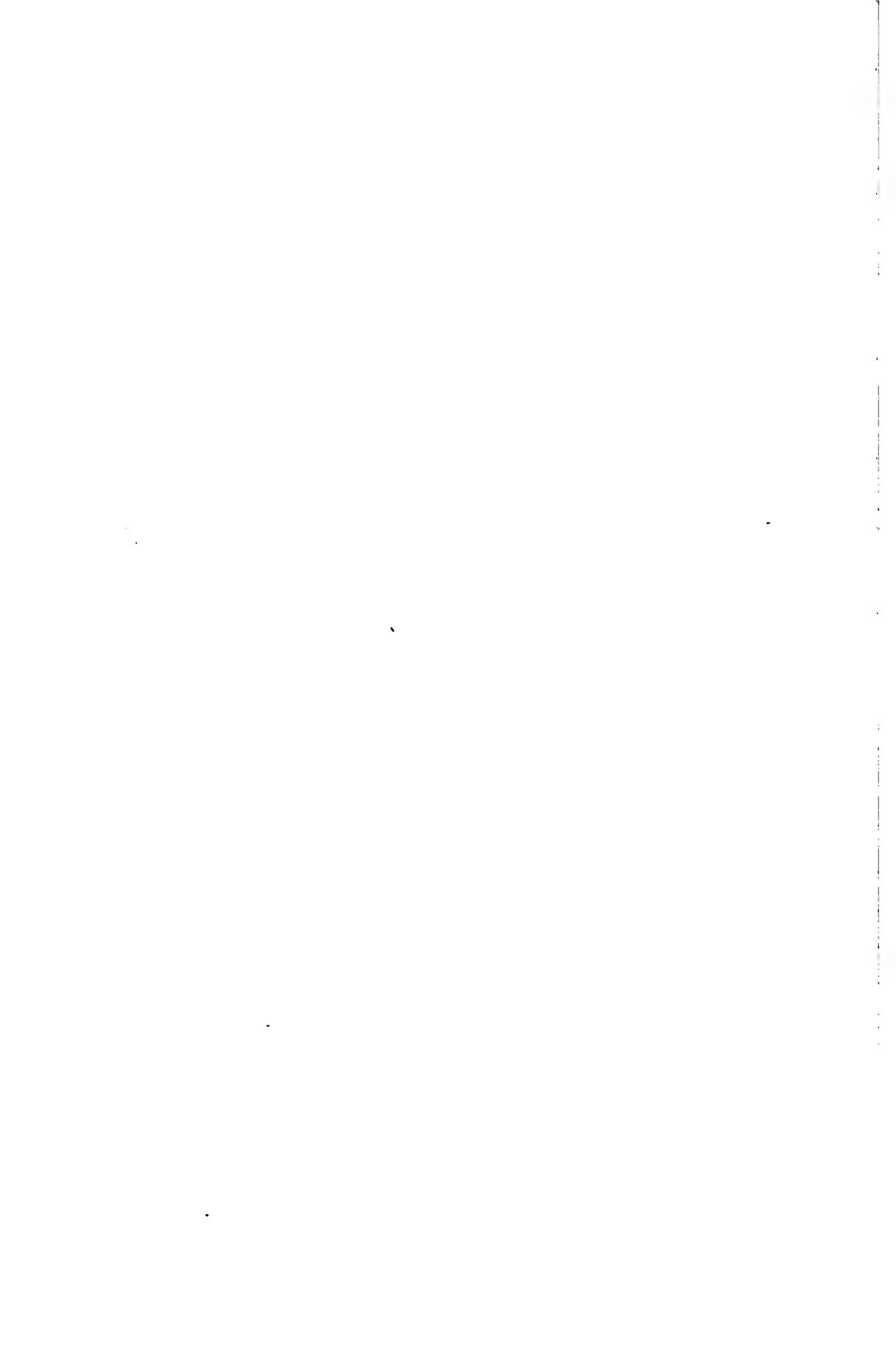
The yield or annual cut is fixed by working plans prepared for periods of ten years and renewed after the lapse of such periods. Within these periods the annual yield is almost constant. At the end of a period, however, a new working plan might provide for either a higher or

lesser yield. It is an iron-clad rule that on the whole the cut shall not exceed the increment of the forest.

Trees are cut as low down as possible above the surface of the soil; the instrument used is the saw. The stump and the root are dug out afterwards wherever such work is remunerative, viz., where the wood obtained can be sold at a paying rate. In Saxony regular forest management began with the beginning of the century in a systematic way; consequently the forests now existing are almost even aged and composed of trees of almost even size; hence there is no objection to clearing an entire area of given size, say of two or three acres, at once, removing from it every tree standing on it. In exceptional cases, pieces of forest not entirely mature may be sacrificed with a view of saving others from the dangers threatening from storms and insects.

The average age of maturity in Saxony for conifers (spruce) is eighty to ninety years. However, there are cases in which this rule is not adhered to. The size of trees when fit for the axe depends entirely on the species, on the condition of the locality, the means of transportation, etc. Previous to the final cutting, and beginning with the twenty-fifth year of a piece of forest, and ending at the sixtieth year of the forest, thinnings take place at intervals of about ten years with a view to allow increased light and increased space to the most promising specimens of the growing stock. Specimens growing less vigorously, dying or dead, are removed at the same time wherever it pays.

There is no difference in the rank of the forest officer compared to that of any other state officers employed in the technical branches of the government. The state forestry service is divided into a lower and higher branch. The professional training for the first one is a merely practical training, whilst the latter necessitates scientific preparation of a high class. The requirements with reference





to this scientific preparation are as follows: Graduating from a state gymnasium; six months of practical instruction under a forest officer on one of the state forest ranges; twelve months' study at a university; two and a half years' study at the forest academy at Tharandt, at which two examinations must be passed; three years of practical professional training under a forest officer and at the bureau of forest working plans at Dresden; examination by the state authorities. After this preparation, as soon as there is a vacancy, appointment as government officer might follow, to begin with as assistant of an Oberförster (Superior Forester); then as superior forester, and so on up to the higher ranks of chief of a forest territory or chief of the bureau of forest working plans. The latter officers have the title of "Superior Forest Master." The highest technical authority controlling the local and territorial officers is called "State Forest Master." There are 108 local ranges in Saxony allotted to 11 territorial districts. The former are in charge of a superior forester (Oberförster), the latter in charge of a superior forest master. The central bureau of the entire state forestry service is under the Secretary of Finances.

The salary of a superior forest officer averages \$1,015 (from \$1,150 to \$1,180), to which must be added an allowance of \$566 for traveling expenses, horse keeping and the use of a house free of rental. The salary of the Superior forest master averages \$1,486, ranging from \$1,274 to \$1,698, to which must be added a traveling allowance of \$708 and the use of a house free of charge.

In the case of physical disability the forest officers draw a pension depending on the duration of their state service and on the salary received so far. This pension is at least 30 per cent of the salary. In no case does it amount to over 80 per cent. The latter figure is paid after thirty-nine years or more of state forestry service. At the age

of sixty-five years the state forestry officer is entitled to a pension in case he desires to retire, even if his constitution would enable him to continue in the service.

No annual report of the Saxony forest administration is published.

"Das Tharandter Jahrbuch" is considered the best periodical on forestry.

As further information, it may be stated that the administration of a forest range, by the superior forester under the supervision of the superior forest master, is outlined by "the working plan" which is prepared by the bureau of forest working plans at Dresden, containing prescriptions for a period of ten years. The superior forest officer co-operates in the preparation of this working plan, which has to be submitted to the secretary of finances. The preparation of a working plan is based on a thorough knowledge and a thorough scrutinizing of the conditions of the forest range, which often takes several months. The forest working plan contains a statement showing the areas of the different compartments or units of the forest range; it contains a description of these compartments and maps of the same; all sections of the forests are examined with reference to their increment. All these investigations made, the forests or sections of forests to be cut during the next decade of years are selected and pointed out specifically. Further, there is stated specifically what compartments or sub-compartments are to be thinned out, what areas are to be planted up, and by what means regeneration is to be effected in each single case. Deviations from the prescriptions of a forest working plan must not be made unless authorized by the secretary of finances. Every working plan is controlled by the state forest master in the range itself. Besides, in the midst of the ten years period, or after the lapse of five years, such a control by the highest forest officer of the state takes place, so as to find out whether and in how

far the prescriptions of the working plan have been followed and whether deviations might be advisable.

The sale of the forest produce (timber, fuel, bark, stones, etc.) is done by the superior forest officer with the help of a local state cashier, who is holding an office absolutely independent from the forestry service and is directly subordinate to the secretary of finances. This arrangement makes embezzlements practically impossible. The sale of timber and fuel takes place, after they are cut and piled up, by means of public auction. The cutting and piling of timber and fuel is done by common hands working under a contract. Any planting, on the other hand, is done by day workers, under the supervision of the local rangers, so as to warrant careful work.

PRIVATE FORESTS.

According to a statement made for the year 1893, the total area of the private forests in Saxony is 539,000 acres. All forests owned by municipalities and villages and other corporations, and a considerable fraction of the larger private forests, are managed according to true forestry principles. All administrations of municipal, town and village forests are controlled by the state. The working plans for these forests are prepared by the bureau of forest working plans at Dresden. In these cases, the forest working plan is approved of by the secretary of the interior, and not by the secretary of finances, as would be the case for state forests.

It is impossible to give any data as to the average value per acre of communal and private forests. Neither are data available as to their average annual yield. Generally speaking, the yield of private and communal forests is considered to be lower than from state forests. Wherever there are working plans the cut is steady, and even during the period over which the working plan extends.

Where there are no working plans, the cut depends entirely on the pleasure of the owner.

Small holdings of forests, especially those of the peasantry, are deteriorating. Parts of such forests are changed into fields or meadows; other sections are purchased by the state, communities or wealthy private individuals.

GRAND DUCHY OF SAX-WEIMAR.

The area of state forests is 110,910 acres, of private forests 120,510 acres, in the aggregate 231,420 acres, being equal to 25.6 per cent of the total area of the state. The state forests comprise 37 units of administration, in charge of 37 superior forest officers, trained at the forest academy of Eisenach.

The control of the local forest administration is effected through six forest inspectors, the highest authority in forestry matters being represented by a forestry bureau, attached to the office of the secretary of finances. Forest working plans are prepared and their execution controlled by the "Commission of Forest Working Plans," at Eisenach, the director of the forest academy being at the same time chief of that commission. The annual yield of the state is 5,864,177 cubic feet of lumber and firewood, corresponding with about 125 feet board measure timber plus 0.31 cords fire-wood per acre per annum.

The main duties of the superior forest officers consist of: Care of the property; maintenance of boundary lines; preventing the acquisition of prescriptive rights to pasture, litter wood, etc., by outsiders, and preventing forest offenses; maintenance of the growing stock of timber; forest utilization and forest regeneration, as prescribed by the working plans; sale of forest produce and control of the book-keeping.

SWEDEN.

STATE FORESTS.

The aggregate extent of the state forests of Sweden in 1895 was 18,080,753 acres. The area of state forests is annually increasing by extensive purchases of private forest. The prevailing kinds of trees are spruce (fir), pine and birch. The estimated value of the state forests is \$4 per acre. The figures in this statement are for the year 1895, in which the aggregate expense of forest administration was \$185,397, and the aggregate revenue was \$1,126,636. The number of acres sown or planted to forest was 10,875. The number of acres damaged by fire was 1,200, and the amount of damage was about \$10,000. Neglected camp fires and carelessness when burning fields for cultivation are the principal causes. Only three fires were caused by railroad locomotives. The state forests are divided into 9 districts and 74 ranges ("revir"). The chief of a district is an officer entitled "Öfverjägästare," with annual salary of \$1,707 and rank corresponding to the rank of major in the army; the chief of a range ("revir") is an officer entitled "Jägästare," with a salary of \$1,200 and rank corresponding to that of captain in the army. Before any one can be appointed as "Jägästare" he must have passed successfully the examinations required after a year's attendance at one of the forest schools, the examinations required during a two years' course at the College of Forestry at Stockholm, and must have practiced forestry a year on a range. Foresters or guards receive a salary of \$160. The state provides dwellings in the vicinity of the forests for officers and foresters. At the head of the forest administration is a director general, with salary of \$2,400, and having rank corresponding to that of a major general in the army;

and a chief of bureau, with salary of \$1,867 and rank corresponding to that of a lieutenant colonel in the army.

There is a continuity of forest product based upon certain plans of cultivation. Reforesting is effected partly by sowing, partly by planting, but principally by seeds from standing trees, assisted by planting. The usual method of harvesting the forest crop is, in the southern part of the country, by cutting in blocks clean; in other parts of the country by cutting trees only down to a certain size fixed by law. The total forest product of the country is sustained, and it is increasing.

PRIVATE FORESTS.

The aggregate extent of private forests is 58,715,135 acres and their average value per acre is estimated at about \$5. About twenty-five per cent of private forests is managed on forestry principles. A royal committee is preparing a project of forest laws to promote re-growth of private forests.

FORESTS OF THE UDDEHOLM COMPANY, SWEDEN.*

The forests of the Uddeholm Stock Company are situated in nine parishes in the province of Vermland and in two parishes of the province of Dalarne. Karlstad, on Lake Wenern, about fifty (English) miles distant, and Gothenberg, about one hundred and eighty miles distant, are the nearest export harbors. Lake Wenern is connected with the Baltic and also the North Sea by the Gotha and Trollhatte (canals). The company owns fifty-six miles of railroad—Nordmark-Klarelfven—with thirteen stations, which transports all sorts of goods, especially iron and lumber, to and between the works. The company owns 400,000 acres of land in Vermland and 25,000

*Information furnished in Swedish by Dr. Fredrik Loven, chief forest master, through Mr. Gust. Jansson, manager of the Munkfors Iron Works.

acres in Dalarne. About 60,000 acres have been acquired within the last ten years. Of the entire area, not exceeding 60,000 acres consist of naked tracts, fields, meadow, also unproductive surface of moss, lake and rocky elevations; while at least about 375,000 acres consist of natural forest-bearing land. Hereof perhaps 15,000 to 18,000 acres are pasture land. Pine comprises 70 per cent of the forest, and spruce 30 per cent of all trees large enough for the saw. The birch is the prevailing species within the pasture, but among the birch conifers are generally found.

The Uddeholm Company's lands lie on both sides of the Klar river along its middle course. The parish of Råmen, in Vermland, and the boundary of Dalarne terminate the extent of the property on the east and the two judicial districts of Fryksdal on the west. About 375,000 acres lie in one body. Only a very little public forest and some belonging to farmers are included therein here and there. The rocky elevations consist of primary rocks, principally granite and gneiss, with interspersed hills of hyperite. West of the Klar river red iron gneiss is almost the prevailing rock, but east of the same river granite prevails, in large part solid, not crystalline, but there are large tracts of primary granite poor in feldspar. On granite, pine prevails to the extent of 75 to 80 per cent, while on gneiss spruce occupies at least 40 per cent of the surface. On the "hyperite" hills spruce of large growth prevails. The soil in the forest is composed partly of the disintegrated rock such as above mentioned and partly of deposits of older or later water courses. Much of the soil is gravelly; much also is sandy. The Klar river within the region of the Uddeholm forest is 400 feet above the sea, and on the east and west sides rise very steep hills which at a distance, generally of a thousand yards, attain a height of from 1,000 to 1,500

feet above the sea; thereafter they take a plateau form, but are very often broken by water courses or bogs. The whole region is thereby in a large degree of that cut or broken character which one can readily obtain an illustration of by ascending one of the principal heights. The highest and only actually barren-topped mountain in the company's forest is Harfjellet, 2,200 feet above the sea. Another, Tönnet mountain, 1,700 feet above the sea, is called a "fjell" (barren-topped or snow-covered mountain), but it is not actually that, for it is partly forest-covered.

Agriculture takes a subordinate place; the land most suitable for cultivation is generally along the banks of the larger streams. About 700 persons occupy small farms as tenants and are obliged to produce certain quantities of charcoal, in general 6,600 bushels each, and in all 4,620,000 bushels. They are also obliged to transport the coal to the works. Besides, there are several hundred forest laborers with smaller premises on which one of two cows and several smaller animals are fed. About 14,000 persons live and gain their livelihood on the company's property.

About 3,000 acres (2,700 to 3,000 "tunnland"; one tunnland being equal to 1.22 acres) are consumed or cut over annually; though it is not easy to say just how much, because clean cutting and selection cutting (cutting only the larger trees) are both practiced. On an average every tunnland (1.22 acres) ought at the end of every rotation period—120 years for pine and 90 years for spruce—yield from 4,000 to 4,500 cubic feet of lumber.

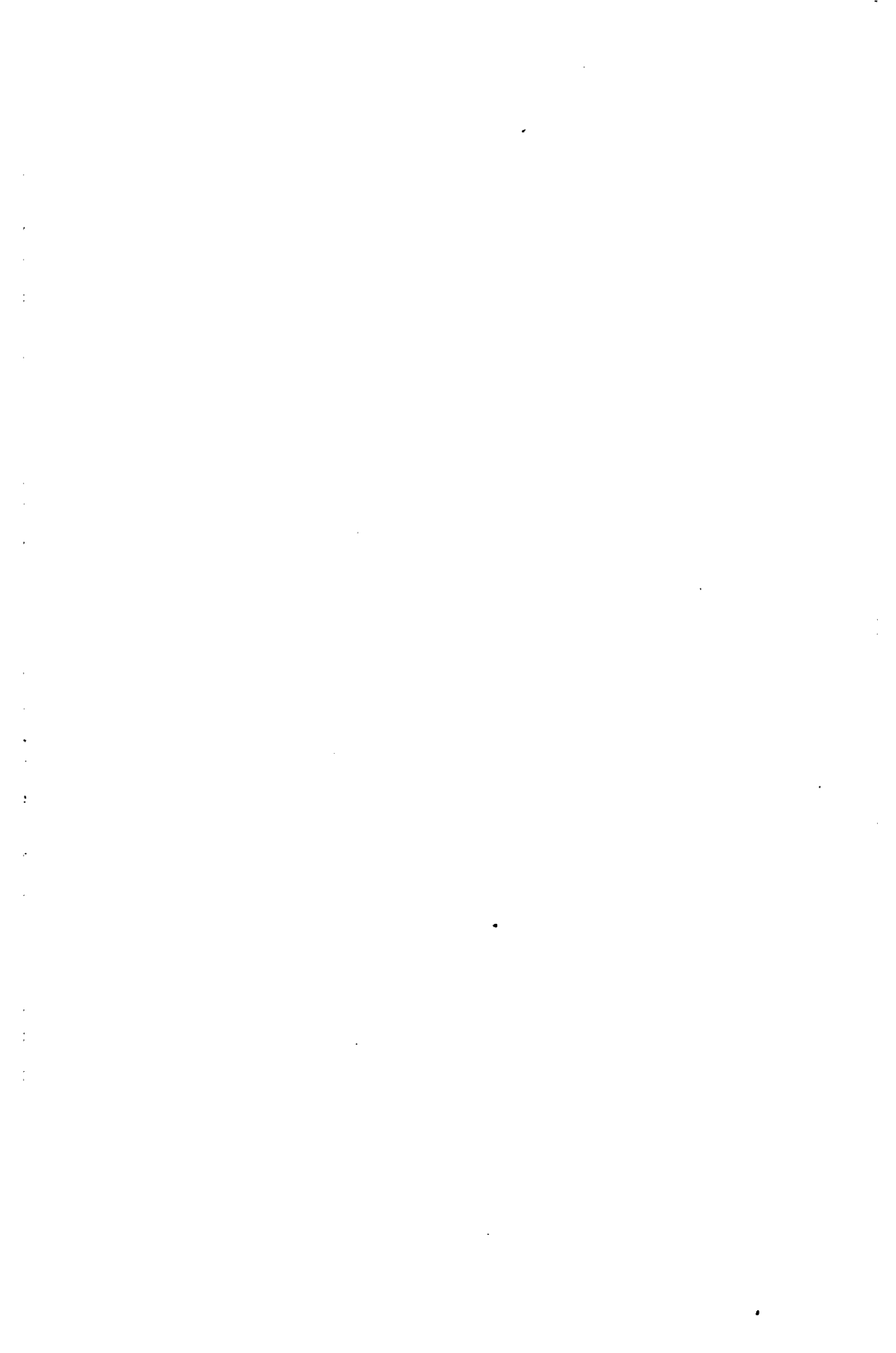
The forest is handled by means of cutting trees that hinder the growth of others or which are themselves defective ("hjelp och rensningsgallringar"), and thinning to admit light ("ljushuggningar"), consisting of two to three careful timber cuttings with an interval of 15 to 20 years,

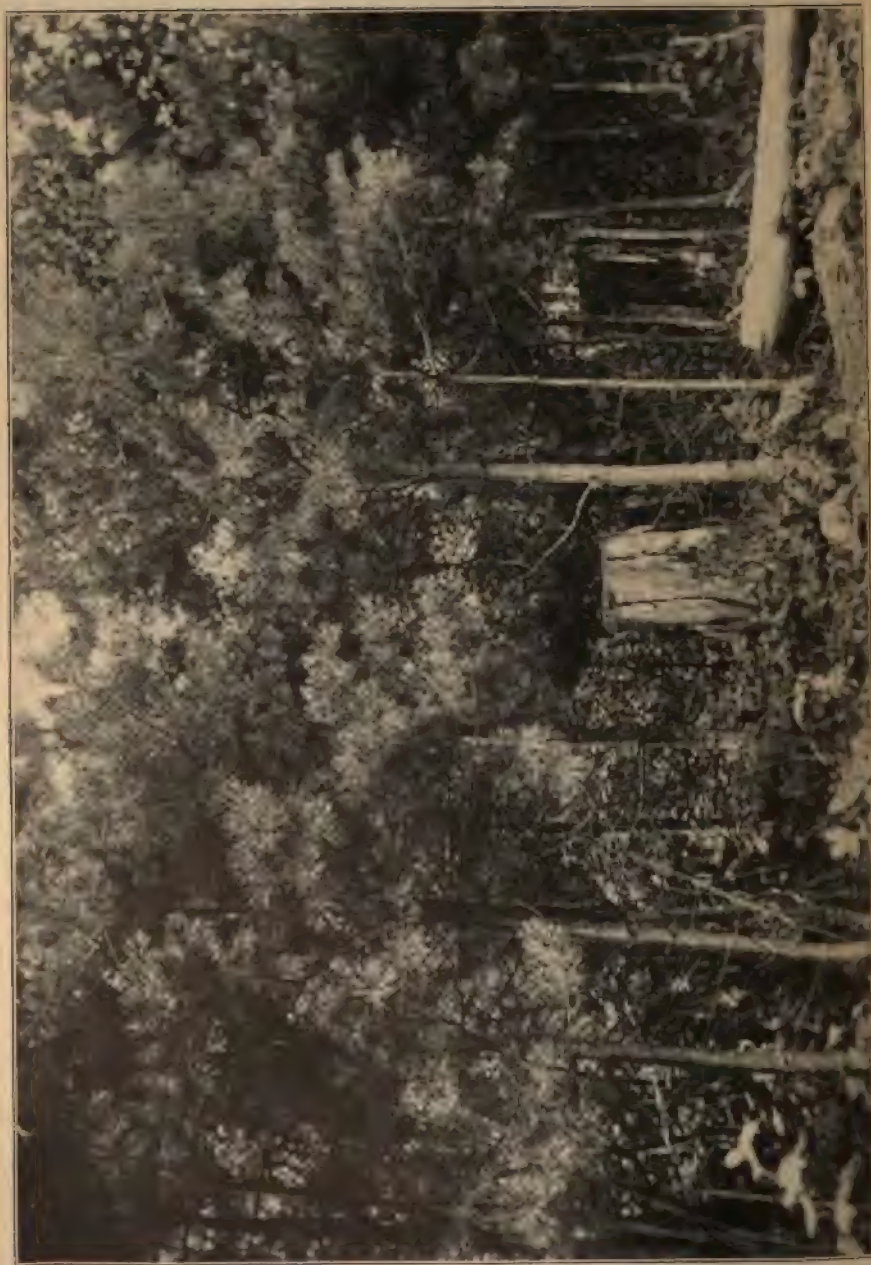
which end either by leaving seed trees or in clean cutting. The best stands of pine are finally cut at the age of from 130 to 140 years, and the middling at the age of 120 years, and the poorer at the age of 100 years. The spruce stands in which thinning is much practiced are nevertheless very sensitive to damage from excess of light, wherefore timber cutting must be undertaken with great care and skill, otherwise drought occurs. Spruce is cut at the age of 70 to 100 years, according to its quality. During the past ten years there has been cut yearly 12,000,000 cubic feet of lumber of various sorts, namely, of saw and building timber, 2,000,000 cubic feet; spruce for paper pulp, 850,000 cubic feet; telephone and telegraph poles, 125,000 cubic feet; firewood, 2,275,000 cubic feet; wood for charcoal, 6,600,000 cubic feet; miscellaneous, 150,000 cubic feet. Besides, there was each year brought to the works and consumed stub-wood to the amount of 1,500,000 cubic feet.

Certainly not more than 15, or at the highest 20, per cent of the cut-over area becomes restocked by natural seeding. The cuttings are not so large but what the by-standing trees can in an essential degree contribute to renewal, and, besides, very often 15 to 20 seed trees are left on each 1.22 acre tract. The difficulties which forest culture meets with in this locality are very stony land, spring and summer drought, spring frost, sometimes, as during the previous year, excessive rain, mossy or swampy land and land heavily pastured by cows and sheep. On the other hand, the forest area is not much troubled with heath, strong growth of grass, insects, etc. In regard to sowing, the twigs are burned immediately after the frost is out of the ground, and while the ground is damp. Generally the following year the cleared area is sown with pine and spruce seed. On pine land spruce seed is mixed to about 50 per cent. On land which is suitable

for both, 60 to 70 per cent of spruce seed is used. On pure spruce land 15 to 20 per cent of pine seed is mixed in. On cleared land, to prevent injury from drought, long, narrow seed strips—made by hatchets—are used about a yard apart, not large squares; but when heath or grass growth is to be feared then planting is to be preferred. For hacking of these seed strips are selected places which are suitable for the growth of the seeds and protection of the plants, such as the north side of shading objects,—for example, stumps, windfalls, fixed rocks, etc. The seed is laid on the south corner of the seed strip so that seed and plant will be better shaded. When sown on rocky land it has to be raked and covered by hand. On even ground the seed strips should be made in a direction from east to west, and the seeds not deep, harrowed down along the south border of the strips. On the other hand, on steep descents the seed strips should be laid horizontally, so that the seed, in case of heavy rain, shall not be washed down the hill. During the latest ten years there have been yearly about 2,400 acres sown with from 800 to 900 kilograms of conifer tree seed.

The planting of forest trees takes place on the company's land on a small scale and only where strong growth of grass hinders the growth of young forests. That is usual on good spruce land. There are planted four-year-old transplants from four to five feet apart, so that the number of plants on a tunnland (1.22 acres) varies between 2,250 and 3,500. The average number of trees standing on an acre at the time of cutting is very different, depending on previous cuttings. To more fully answer this question as to old forest on gravelly land which has not been subjected to other cuttings than the thinning of too crowded trees and cuttings of defective trees, the number of trees on two tracts, each of two and a half acres extent, have been counted with the following





Natural regrowth of white pine where pine timber was cut about 20 years ago. In center, about 100 feet east of Vermilion Lake. Photographed May 10, 1905, for the National Forest of the Lake Umbagog, Vermont, U. S. National Forest Service.

result: First tract, average pine land, pure stand of pine; average age, 135 years; average height, 85 feet; diameter measured 5 feet from ground. There were found 8 trees with diameter of 5 inches, 13 of 6 inches, 20 of 7 inches, 27 of 8 inches, 34 of 9 inches, 42 of 10 inches, 44 of 11 inches, 44 of 12 inches, 53 of 13 inches, 40 of 14 inches, 30 of 15 inches, 16 of 16 inches, 11 of 17 inches, 3 of 18 inches, 2 of 19 inches; total, 385 trees, containing 9,178 cubic feet. Second tract, good pine land; young spruce successively grown up; pine of average age of 130 years and average height 85 feet; there were found 3 pines and 37 spruces 5 inches in diameter, 44 pines and 58 spruces 6 inches, 61 pines and 37 spruces 7 inches, 77 pines and 28 spruces 8 inches, 76 pines and 11 spruces 9 inches, 82 pines and 7 spruces 10 inches, 83 pines and 6 spruces 11 inches, 73 pines and 3 spruces 12 inches, 53 pines and 1 spruce 13 inches, 30 pines 14 inches, 14 pines 15 inches, 9 pines 16 inches, 5 pines 17 inches, 1 pine 19 inches, 2 pines 20 inches (in diameter); total, 613 pines and 188 spruces, in all 12,013 cubic feet.

Thus were found about 300 trees left per "tunnland" of about 5,300 cubic feet, which, according to an average age of 133 years, shows a yearly average growth of 40 cubic feet per "tunnland" (1.22 acres). If, on the other hand, timber cutting is done once or twice before the final cutting, as is usual, the number of trees at the last is much less. To prevent forest fires, during very dry weather, strict watch is kept by 30 forest guards and by extra ones, and in addition all of the company's dependents are obliged, when a forest fire breaks out, to send notice to the forest guard or forest manager and assist in extinguishing it. Generally the precautions are effective in preventing such fires. No forest fire worthy of mention has occurred in twenty years.

The company's land has been used for forest more than

100 years. It cannot be said what the net revenue is per acre, as the greater part of the product is used at the works in form of coal or fuel. The average yearly growth per "tunnland" ought to be 40 cubic feet, of which one fourth, or 10 cubic feet, should be saw timber of the net value of 1.50 kronor; 10 cubic feet of building timber, worth 1 kronor; 20 cubic feet of wood, worth 0.70 kronor, or, for the 40 cubic feet, 3.20 kronor (equal to \$0.85).

The income from game is not large. There are shot annually 12 elks, many hares and game birds.

SWITZERLAND.

The Swiss Confederation is composed of twenty-two cantons, which are separate and sovereign states; and while each canton has legislative authority over forests, the Confederation also exercises legislative authority over them in certain regards. Under article 24, of the Federal Constitution of May 29, 1894, the Confederation controls only the forests of the high regions, which are about 65 per cent of the total forest area of Switzerland. It is true that since the popular vote of July 11, 1897, which revises the said article 24, the Confederation has from now on the right of inspection of the forest police of the whole of Switzerland.

The federal law of March 24, 1876, which puts into execution the above-named article 24 of the constitution, was promulgated for the forests of the high regions. By the terms of that law the inspection by the Confederation extends over the entire territory of the cantons of Uri, Schwytz, Unterwald, Glaris, Appenzell, Grisons, Tessin and Valais and over the mountainous parts of the cantonal territories of Zurich, Berne, Luzerne, Zoug, Friburg, St. Gall, Jura and Vaud; but the law does not apply to the forests of the plains of the last mentioned

states, nor to the forests of the cantons of Soleure, Bale, Schaffhouse, Argovia, Thurgovia, Neufchatel and Geneva.

The Confederation is not actually the owner of any forests, but a few of the separate states are owners. The forest domains are part of the national wealth, and comprise 91,587 acres. There are also in the cantons the forests of the municipalities and of the corporations, comprising 1,403,772 acres. Besides there are private forests, comprising 609,855 acres. The total area of forests is therefore 2,105,220 acres, or about 20 per cent of the total area of Switzerland.

Forests are found everywhere in Switzerland. The parts most heavily timbered are the mountain chains of Jura and of the cantons of Schaffhouse, Soleure, Argovie and Neufchatel. Forests are found starting at 200 meters above sea level (in the canton of Tessin) and reach as high as 2,100 meters in the high mountains. In Argovia they even reach 2,300 meters in altitude.

The more common varieties of trees are among the resinous kinds, the opicea, the fir, the larch, the Scotch and mountain pines, the Siberian pine; among the deciduous kinds, the birch and the chestnut tree; this last kind grows especially in the canton of Tessin.

The value of forest land varies greatly and depends on the location, the nature of the soil, thickness of the settlements, the increase of these settlements and on the trade in timber and other products of the forest. The value per hectare ($2\frac{1}{2}$ acres) may range accordingly from 300 francs to 6,000 francs.

In regard to expenses of administration, a distinction must be made between the expenses incurred by the Confederation and those incurred by the cantons. In 1897 the expenses incurred by the Confederation for forest administration amounted to \$56,000.

The following are the net receipts from forests in 1896 as to a few cantons :

Zurich, 180,900 francs, or 91.06 francs per hectare of forest.

Berne, 893,000 francs, or 71 francs per hectare of forest.

Soleure, 33,400 francs, or 44 francs per hectare of forest.

St. Gall, 71,000 francs, or 84.60 francs per hectare of forest.

Argovie, 241,000 francs, or 78.73 francs per hectare of forest.

Vaud, 236,000 francs, or 32 francs per hectare of forest.

The net receipts from town and municipal corporation forests in 1896 were :

Canton of Grisons, 1,200,000 francs, or 10.40 francs per hectare of forest.

Canton of Argovie, 2,378,000 francs, or 70.60 francs per hectare of forest.

On an average about 412 acres of forest have been created annually during the past twenty years, at the expense of the federal treasury.

In order to regenerate the forests, both planting and natural seeding are practiced, as may be most effective.

In the lowest countries, where clean cutting is practiced, planting is resorted to. Where real dangers exist from avalanches, land-sliding, etc., which do not permit complete denudation, and where gardening is required, natural modes of regeneration are generally used, and sowing is seldom done.

Reforestation by the Confederation in high mountain regions costs on an average 400 francs per hectare for 6,000 to 7,000 plants set in their places.

The federal and cantonal legislatures prescribe a sustained production for the forests of the state, of the towns and of the municipal corporations. If, through winds, snow-slidings or otherwise, too much timber has been destroyed, less cutting is done in the following years, in order that as rapidly as possible the forest may regain the number of trees fixed by the management. The forests are operated in various ways, according to localities and ac-

according to the size of timber that is to be grown, viz., high forest, under-growth and coppice.

In accordance with the terms of the federal law, the forest area cannot be reduced. The cleared land must consequently be reforested except in cases where an equal area of land is covered into forest. Furthermore, the cantons as well as the Confederation have the right to compel the creation of protective forests wherever they are needed for public utility.

Forest fires seldom occur. Of those which do occur the principal causes are carelessness in lighting fires in the immediate vicinity of the forests, and lack of care in the woods. It is rare that a forest fire is occasioned by locomotives.

The administration charged to execute the federal forest law is the Federal Inspectorate of Forests, forming a part of the Swiss federal department of the interior. Nearly all the cantons have for their territories a forest administration. In the small states one single technical official is at the head of the service, but in the larger cantons the administration is under the direction of one or more chief forest inspectors or chiefs of the service and of several district foresters or forest inspectors. An inferior personnel instructed for the federal zone in courses lasting two months is attached to this technical personnel, and is organized to execute the work of forest economy.

A few cities or towns with extended and important forests have also a self forest administration, at the head of which is a person of technical forest training. Among them are Zurich, Berne, Lausanne, St. Gall, Winterhue, Friburg, Coire, Soleure, Schaffhouse.

The Chief Federal Inspector of Forests has an annual salary of 8,000 francs and fees of eight francs per day, and eight francs per night, when he has to be absent, for his service; he gets his traveling expenses reimbursed,

his first assistant has a salary of 6,400 francs and is similarly indemnified for his inspection trips.

The three inspectors of the canton of Berne receive each 5,300 francs per annum. They receive extra pay, six francs per day and four francs per night, for all inspections made outside of their city, and their traveling expenses are reimbursed.

The high forester or chief inspector of the canton of St. Gall, who has a salary of 5,000 francs, receives ten francs per day and four francs per night, besides his traveling expenses, when out inspecting.

The Federal Inspectorate of Forests publishes every year a report on its management. The majority of the cantonal inspectors do likewise.

In the matter of taxes, the cantons are sovereign in their own limits. Taxation therefore differs according to the cantonal territory to which it applies. In all these states a tax on the forest is imposed, and in most states that tax is combined with the tax on income. But for one and the same forest only one of these two modes of taxation is generally applied. A few examples will show: In the canton of St. Gall the state has paid to the towns in which it has forests a tax of 1.20 francs per hectare. In Argovie the state pays to the towns where its forests are situated a tax of 2.40 to 3.20 francs per 1,000 francs of forest value. On the other hand, the towns only pay to the state a tax of 40 centimes per 1,000 francs of forest value. The private forest proprietor pays to the state 40 centimes and from 2.40 francs to 3.20 francs to the towns per 1,000 francs of forest value; and in addition thereto he is taxed on the income in the amount of one per cent of the average two per cent of gross declared value of the forest, but neither the state nor the towns pay a tax on the income of their forests.

WURTEMBERG.

Wurtemberg lies west of Bavaria, and is the third German state in point of area, its population being a little over 2,000,000. Its greatest length from north to south is 140 miles, and its greatest breadth is 100 miles. One-third of the Black Forest (so called from the dark foliage of its pines), and which forms a sort of a triangle, lies within Wurtemberg, two-thirds being in Baden. The Black Forest has a total length of 93 miles, and its breadth varies from 13 to 46 miles.

STATE FORESTS.

The aggregate extent of the state forests is 418,904 acres, and they extend over the entire kingdom. Fifty-nine per cent of the forests consists of pine, 20 per cent being pitch pine and 9 per cent white pine. The estimated value of the forest land varies from \$29 to \$58 per acre. The annual aggregate expense of administration of the forest amounts to \$1,183,574. Of this \$364,140 is paid to wood-cutters, \$147,560 is expended on roads, \$90,440 in forest culture, \$259,468 for pay of officials, \$148,468 for forest guards. The revenue was \$2,928,352, yielding a net revenue, after for 1895-1896 deducting all expenditures, of \$1,744,788, or \$3.63 per acre. The number of acres annually sown to forest is 296, and the number of acres planted to forest 6,177.

In regard to reforestation, when the natural seeding of the desired kind of wood occurs in proper time the same is used ; otherwise planting or artificial growing takes place. Natural sowing is estimated at about 25 per cent ; artificial renewing amounts to about 75 per cent. The latter is almost exclusively done by planting, whereas sowing in free woodland is very seldom applied. It is a principle to maintain (as far as the division of the age of the plantings

permit) an equal annual cutting. At present the cutting is fixed at 1.94 cubic meters per acre. The cutting is contracted for with laborers living in the neighborhood of the woods. By good management there are at a given plot generally trees of about the same age. If the natural seed falling is intended to be used, the larger trees, either single or in crops, are cut out in a direction against the prevailing winds; the remaining trees are thinned and gradually cut out as the growing young trees may demand. If the natural seed falling is not taken into consideration, the wood crop is cut clean in narrow strips, also in a direction against the prevailing winds, and the cutting of the second and following strips is postponed until the young plantings can dispense with the side protection of the old woods. It is a principle that replanting follows immediately after the cuttings. Moreover, the state buys every year about 400 acres of woodland to increase and round off the forests.

The amount of damage annually caused by forest fires is only \$642.60, and the principal cause of such fires is carelessness and negligence while smoking and lighting fires in or near the forests. In the last ten years, out of 120 forest fires only 8 were caused by sparks from locomotives, and of these only one caused considerable damage (about \$3,570).

In regard to the rank in the forest service, as compared with other branches of the public service, it may be said that the forest officials rank in general equally with those state officials who are graduates of the university. The Department of Forests is directed by one president, four technical and four administrative members and one commander of the forest guards. The salary of the president is \$1,844.50 per year; the salary of the members of the Board of Direction is from \$1,190 to \$1,618. A work entitled "The Forests of Wurtemberg," published by

Rueger, Stuttgart, 1880, gives a fair review of the situation of the forestry of the country. It may here be stated that in respect to net revenue Saxony and Wurtemberg stand at the head of forest administration and forest culture in general.

PRIVATE FORESTS.

The aggregate extent of private forests is 528,794 acres, of which 210,000 acres are administered by technical forest officials; the remainder is also administered in a proper manner. As the permission of the government is required for cutting and replanting of forest lands, and this permission is only given under the condition that an equal area to what has been cut shall be planted, the aggregate area of forest land remains the same throughout the whole country; but portions of it are gradually coming into the possession of the state government.

FREDERICK THE GREAT, THE FATHER OF GERMAN FORESTRY.

Frederick the Great promulgated laws in 1740 and 1754 for regulating the cutting of wood, which previously had been done as everyone pleased, without any regard to replanting. In place of such improvident practice he established rotations of 70 years; that is, he provided that forests should have 70 years in which to mature before being cut, also prescribed methods of thinning so that the young and healthy growth of oak and beech would be better protected. Later instructions were issued in 1764, 1770, 1780, 1783. In addition to this he instituted communal forests under the care of wardens, forbade private owners from every wasteful cutting and placed under the care of the state a portion of the forests in Silisia which previously

had belonged to private parties. Frederick the Great ordered the division of the national forests into compartments or blocks, each of which was to acquire the age of 70 years before being cut. But inasmuch as it was found that 70 years were not sufficient for the proper growth of the trees, each of these main compartments were subdivided into two compartments, so that a period of growth running 140 years was established.

There had been, in more ancient times, laws relating to forests for certain parts of Prussia, the first dating 1547. These related to the right of using the forest and necessity of replanting, more than to general systematic care. One can therefore properly claim that Frederick the Great is the father of the German forests, as it was he who created the existing forestry laws and made them apply to private as well as to state forests.

THE WORKING PLAN.

The "Manual of Forestry" in five volumes, by Dr. William Schlich, principal professor of forestry at the Royal Indian Engineering College, Cooper's Hill, England, and formerly Inspector General of Forests to the Government of India, is the best work on the subject in the English language. Dr. Schlich has kindly given me permission to copy from his third volume an account of the "working plan" as used in forestry, and what follows on that subject is taken from that volume.

Forest working plans regulate, according to time and locality, the management of forests in such a manner that the objects of the industry are as fully as possible realized. The working plan for a protection forest, or a park-like forest, is altogether different from that of a forest which



Forest on Pelican River, St. Louis County. Wild Rice on right. Photographed August 16, 1904, for the annual Report of the Chief (Forest) Fire Warden of Minnesota.

is managed on economic principles. The latter is the kind with which we have here to do.

The working plan report is a document which gives necessary information and which describes the system of management in such detail as may be required in each case. For forests which are of great value, and which yield high returns, very detailed plans should be drawn up; for forests which give as yet only small returns, simple plans would be indicated.

WORKING PLAN REPORT.

INTRODUCTION.

I.—GENERAL DESCRIPTION.

1. Name and situation of forest; name of proprietor.
2. Boundaries.
3. Area.
4. Configuration of the ground.
5. Rock and general character of the soil.
6. Climate.
7. Legal position of forest, rights and privileges.
8. Surrounding population and its requirements.
9. Markets, lines of export.
10. Prices of the several classes of produce.
11. Cost of extraction and of transport to markets; supply of labor.
12. General description of forest growth.
13. Injuries to which the crop is exposed.
14. Rate of growth.
15. Yield tables, volume tables. form factors, reducing co-efficients, etc., used in the calculation of the volume and increment of the woods.
16. Organization and strength of the forest staff.

II.—DETAILED DESCRIPTION OF COMPARTMENTS.

III.—DIVISION AND ALLOTMENT OF AREAS.

IV.—DESCRIPTION OF THE METHOD OF TREATMENT.

1. The objects of management.
2. Choice of species.
3. Choice of silvicultural system.
4. Determination of the rotation.
5. General lines of treatment.
6. General lines of yield.

V.—SPECIAL WORKING PLANS.

1. Plans of utilization.
 - a. Final cuttings.
 - b. Intermediate cuttings.
 - c. Minor produce.
2. Plan of formation.
3. Plan of other works.
4. Maps illustrating the condition of the forest and the proposed treatment.

VI.—MISCELLANEOUS.

1. Reorganization of the forest staff.
2. Financial forecast.
3. Proposals for the control of the execution of the working plan.
4. Miscellaneous observations.

WORKING PLAN FOR A PORTION OF THE STATE FORESTS OF
THE HERRENWIES RANGE IN THE BLACK FOREST,
GRAND DUCHY OF BADEN.

PERIOD 1884—1893.

WITH THE RESULTS OF THE ACTUAL WORKING.

GENERAL DESCRIPTION.

1. *Area and Boundaries.*

The areas are recorded as follows:

(a) Productive area	1,747 acres
(b) Unproductive area	nil. "
(c) Other areas, including fields, meadows, etc.	2 "

Total area = 1,749 acres

Alterations in the above figures will probably become necessary when a fresh survey is made.

The outer boundaries are in order, but the internal boundaries require rectification.

2. *Locality.*

The forest here in question occupies on the whole the slopes lying between a hill range on the south and the river Schwarzenbach on the north. The highest point of the hill range, the Hoher Ochsenkopf, has an elevation of 3,465 feet above the sea, while the lowest part, near the Schwarzenbach, is only 2,000 feet above the sea, the mean elevation being placed at 2,600 feet.

The slopes, on which the forest is found, are mostly steep, level spots being only found on the summits of the hills, and toward the lower end, where granite and Bunter Sandstein meet.

The area is drained by the Schwarzenbach (a feeder of the Raumünzach) with its two feeders, the Gartenbach and Dobelbach. The first mentioned runs from west to east, and the two latter, more or less, from south-west toward north-east. It follows that the forest in the valley of the Schwarzenbach has generally a north aspect, and in the valleys of the Gartenbach and Dobelbach a northwest aspect on one side, and a southeast aspect on the other side of the streams. All the forest areas (except those situated at the highest elevations and which are of no importance) are protected by intervening ranges against the prevailing winds.

Up to a mean elevation of 2,500 feet, granite is the principal rock, which is sometimes (though rarely) pierced by porphyry. Above the afore-mentioned elevation the granite underlies upper Bunter Sandstein (Vogesen Sandstein), and the latter accordingly prevails in the larger part of the forest area.

The granite is generally rich in orthoclase and oligoclase, and therefore decomposes readily, and furnishes mostly a deep soil rich in mineral elements. The decomposition is facilitated, and the quality of the soil improved, by the remarkably numerous springs which appear between the granite and the Bunter Sandstein. Hard slow decomposing quartzite is of rare occurrence.

The Bunter Sandstein is characterized by rapidly and greatly changing mineral composition, consisting sometimes of readily decomposing rock yielding a deep clay soil, in other cases of hard quartz-gravel, frequently found on the surface in the numerous bolder-drifts. The Bunter Sandstein has numerous rents and fissures in all directions, so that it is rapidly drained, and the disintegration and decomposition are only rarely assisted by springs, which at the best are scanty and intermittent. It follows that the Bunter Sandstein soils, even when formed by the easily decomposed and minerally rich clay sandstone, never equal the best quality of the granite soil; moreover, they change frequently and very suddenly, and without any visible cause, into almost unproductive areas.

On the flat hill tops, layers of fine white sand (produced by the disintegration of the gravelly sandstone) frequently produces an impermeable stratum, preventing the water from percolating, thus causing bogs (or "Gründe") which often extend over considerable areas and are almost unproductive.

The quality of the soil, therefore, ranges between good and unproductive, in the following proportion:

Good and fairly good to medium	= 78 per cent.
Medium to indifferent	= 12 "
Indifferent to unproductive	= 10 "

The climate is rough, and is characterized by long winters with an abundant snowfall, and by rapid changes of temperature; at the same time it is throughout favorable for forest vegetation, especially for conifers.

3. *Species.*

The details will be found in the description of compartments. Generally speaking, the spruce and silver fir are the prevailing trees, the former being more abundant in the middle and upper parts, the latter at the lower elevations. The beech is associated with them locally and in varying proportions. Scotch pine is found in the granite region chiefly upon dry, steep, rocky slopes with a southerly aspect, and in the sandstone region, especially on dry ridges and the top of the mountains, as well as here and there in other localities. The three conifers attain a maximum height of 140 feet, with regular shaped and little tapering stems. Toward the upper limit of the area the height growth diminishes rapidly, dwindling down to 20 or even 15 feet on the high plateaux. Here the mountain pine and the birch are also found. Reproduction is generally good, except at the higher elevations. A marked difference is found between northern and southern slopes, the growth and reproduction being far more vigorous on the former than on the latter.

The silver fir is much exposed to cancer. Windfalls and snow breakage are fairly moderate, while the damage from insect attacks is very small. During the years 1874-83, the following proportion existed between the different classes of fellings:

Cuttings caused by insect attacks	=	1	per cent of total fellings.
" " snow breaks	=	12	" " "
" " windfalls	=	16	" " "
Cancer and other diseases and injury	=	19	" " "
Other cuttings	=	52	" " "
<hr/>			
Total	=	100	" " "

4. *Method of Treatment and Rotation.*

The situation and the species necessitate the area being treated under the high forest system. The quality gradations, as indicated under 2, are so conspicuous locally that it is possible (as well as desirable in order to secure a proper idea of the condition of the forest), to group the growing stock according to its characteristics as produced by the quality of the locality, and according to the method of treatment thereby indicated. The actual basis of this grouping is the yield, and based upon it, the net income or financial result of the management. In this sense the forest may be divided into the following three groups:

a. Areas Subjected to an Intensive Management.—To this group belong all areas which, in virtue of their quality (as indicated mainly by the height growth of the trees on fully stocked areas) are capable of producing large timber; areas on which carefully conducted regeneration fellings will produce natural regeneration within a reasonable period of time, and where the cost of any artificial assistance in regeneration is commensurate with the anticipated returns. As lowest limit of this group a normal increment of 43 cubic feet per year and acre, calculated for a rotation of 120 years, has been fixed. The area thus included in the group amounts to 78 per cent of the whole. It is with this area, and the growing stock standing on it, that the management must more especially reckon, and from which the

largest possible sustained yield must be secured. With a suitable composition of the growing stock and a careful application of silvicultural principles, that object may be obtained under an average rotation of 120 years.

As regards the silvicultural treatment, and especially the regeneration of the woods, two different classes of forest or growing stock (corresponding with two qualities of locality) stand out prominently.

First: Forest of spruce with a strong admixture of silver fir (the latter occasionally predominating) more or less frequently interspersed with beech and more rarely with Scotch pine.

Secondly: Forest in which spruce predominates with a slight admixture of silver fir and here and there of Scotch pine, but devoid of beech.

The first class of forest occurs in the granite area and on those parts of the Bunter Sandstein (clay sandstone), which have deep, easily decomposed soils fit to be classed as good. The characteristic features of this class of forest are the occurrence of beech and deep soils, rarely covered with boulders or debris, lying mostly at the lower elevations; natural regeneration can here be successfully effected in a comparatively short period of time.

The second class of forest occupies the stony slopes of the Bunter Sandstein area, and in exceptional cases the quartzite parts of the granite area. Here the soil is generally covered with loose boulders and rock debris of varying size. These areas are nearly all found at the middle to upper elevations. The conditions described demand the maintenance of an uninterrupted canopy up to the age of maturity, and a careful execution of the regeneration cuttings spread over a prolonged period of time, or else weeds will spring up, which make regeneration very difficult, and at any rate expensive.

On the whole, however, careful management is sure to be successful in securing natural regeneration in all the areas pertaining to this group; for this purpose, as well as for the production of valuable timber, a rotation of 120 years on an average is considered of sufficient length. The length of the regeneration period differs considerably in the different parts, varying on the whole from 30 to 50 years.

b. The second group consists of woods growing on soils, which, even under the most careful management, cannot be expected to produce trees of first or even second quality. The trees here produced are of such limited height growth, that the production of valuable timber is out of the question. The woods are found in the upper, and here and there in the lower part of the Bunter Sandstein area, where the soil is covered with large masses of the debris of gravelly sandstone, which is not easily decomposed, and where the slightest interruption of the canopy overhead is followed by the appearance of a dense growth of bilberry and heather.

Nevertheless, these areas are capable of yielding timber of the inferior classes, as well as firewood, and the returns which may reasonably be expected from them, justify the application of a method of treatment which, while avoiding any interruption in the canopy and all expensive cultural operations, facilitates natural regeneration; in other words the treatment under the selection system by removing all trees which are deteriorating or incapable of increasing in value. It is difficult to fix any definite rotation, but it is estimated that the trees will take about 150 years to reach maturity.

The lowest quality limit for this group has been fixed at 7 cubic feet increment per acre and year, while the upper limit is, as already indicated, 43 cubic feet. The area comprised in this group amounts to 12 per cent of the total area.

c. The third group comprises the so-called "Grinden," that is to say the highest parts of the ridges, which are mostly level and have a tendency to boggi-ness. They are covered by a dense growth of bilberry and heather, and are incapable of producing more than a stunted tree growth, which yields only a scanty quantity of firewood, frequently not covering the price of preparing it; hence financial considerations are entirely out of the question, the areas being protected merely for the sake of preserving some cover on the hill tops. The group comprises all parts which produce an annual increment per acre of 7 cubic feet and under; they amount to 10 per cent of the total area.

In so far as the management aims at the production of valuable material, and at favorable financial results as regards outlay for artificial regeneration (where natural regeneration has failed), for improvement, tending, etc., only the areas in the first group can be considered. But in the treatment of those forests which pertain to the principal mountain region of the Black Forest, representing a certain drainage area, the task of forestry goes beyond mere financial considerations. It has in fact been recognized that it is necessary to keep areas of this class well wooded for the sake of a proper husbanding of the water supply in the streams. Accepting this further task, the forest administration has endeavored, during the last 50 years, to afforest the poorly stocked and frequently entirely bare areas at the higher elevations of the Bunter Sandstein region. In so far as the cultural operations were confined to the boulder drifts of the Bunter Sandstein, they were moderately successful, but the cultural attempts made in the "Grinden" prior to 1870 turned out failures. Since 1873 the cultural operations in the Grinden present a more hopeful aspect, owing to the experience gained by former failures, and it seems desirable to continue them in the future.

The working plan deals in detail only with the forest area subjected to intensive management, but the group worked under the selection system has also been adequately noticed in the general provisions.

The working plan lays special stress upon the execution of improvement fellings, more particularly the removal of cancerous silver firs. For this purpose the ordinary thinnings are utilized; but over and above these, cancerous trees must also be removed from the old woods, where otherwise no further thinnings would be required. In regeneration fellings the trees to fall first under the axe must be those attacked by cancer. Even then not nearly all cancerous trees can be removed during the next ten years. This fact teaches the management that in future a sharp attack must be made on all cancerous trees at the time of the first and second thinnings, even if a temporary interruption of the canopy should thereby be caused. On the rich deep soils of the granite area, which are almost exclusively concerned in these remarks, even an interruption of the canopy extending over a somewhat lengthy period would not be a misfortune, and preferable to the maintenance of a full canopy consisting to a considerable extent of cancerous trees. The existence of enormous quantities of such trees on the granite area was one of the reasons which led to the yield being fixed at its present rate.

5. Utilization.

a. Yield of Major Produce.—The actual yield during the last 40 years has been as follows:

Compartment.	YIELD, IN SOLID CUBIC FEET.					
	1844-53.	1854-63.	1864-73.	1874-83.	Total.	Area in Acres.
1. Schwarzenbronn....	213,886	122,809	149,848	79,141	565,189	65
2. Schwarzenberg.....	811,518	158,778	200,738	158,965	829,984	211
3. Riesenkopf.....	12,502	47,288	206,242	65,617	881,649	76
4. Mehliskopf.....						84
5. Grünwinkel.....	19,742	124,039	57,423	202,252	404,046	202
6. Döbelbach.....	26,875	42,697	80,195	69,953	169,692	178
7. Hoher Ochsenkopf..						101
8. Kleingartenkopf....	84,256	2,881	1,448	1,024	89,069	76
9. Kleingarten.....	875,687	188,825	256,608	185,573	965,998	862
10. Grossgarten.....	62,544	46,683	26,417	59,118	194,767	176
11. Sachsenbronn.....	84,927	47,788	111,851	106,194	800,255	96
12. Gartenbach.....	86,511	88,845	494,605	156,412	826,383	172
	1,178,196	814,733	1,584,930	1,094,216	4,622,067	1,747
Average per year.....	117,820	81,478	158,492	109,422	115,552	.....
Average per year and acre.....	67.44	46.64	87.86	62.68	66.14	.....

From the appended statistical table it will be seen that the estimated increment of the next ten years amounts to 1,086,130 cubic feet.

The actual growing stock amounts to 9,488,731 cubic feet

The normal " " 7,892,160 "

The surplus of " " 1,596,571 "

The surplus of growing stock is due to a surplus of woods over 100 years old. With favorable prices for timber, the removal of this surplus in the shortest possible time would be advisable, so as to prevent loss of increment, and take unnecessary capital out of the forest, but as prices run low at present, it appears judicious to keep the greater part of it over for a while.

A consideration of the several compartments showed that the removal of the following material during the next ten years is advisable on silvicultural grounds:

Final cuttings 1,146,000 cubic feet

Intermediate cuttings 154,000 "

Total 1,300,000 "

As this amount exceeds the expected increment by 213,870 cubic feet, equal to about one-seventh of the surplus of growing stocks, the yield has been fixed at 1,300,000 cubic feet, or annually:—

Final cuttings 114,600 cubic feet

Intermediate cuttings 15,400 "

Total 130,000 "

If in the course of the 10 years prices should rise, there would be no objection to reduce the surplus of growing stock further by additional cuttings.

The disposal of the yield is effected as follows:

1) Free grant to the Roman Catholic Priest at Herrenwies, =	1,500 cubic feet.
" " " School " =	1,000 "
(2) Sale by public auction and occasionally by private sale, =	127,500 "
Total annual disposals	130,000 "

b. Minor Produce.—The principal items are forest pasture and the removal of litter, the utilization of which is permitted to the Herrenwies settlers, as a privilege.

According to government orders the privilege of forest pasture may be exercised only to such extent as the condition of the forest and the requirements of regeneration may permit. The district forest officer indicates from time to time the localities in which the privilege may be exercised. The privilege of removing litter free of charge is exercised under the same conditions. The exercise of these privileges is nowhere injurious, and may be continued during the next ten years.

The grass growing in blanks, on roads and in plantations has hitherto been sold for the benefit of the State, and, under suitable supervision, the practice may be continued.

The removal of building stones, the sale of plants, etc., is insignificant.

6. Division into Compartments.

The contemplated new division into compartments must be postponed until the projected road system has been completed.

DESCRIPTION OF COMPARTMENTS.

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
<i>I. Ochsenköpfe.</i>			
Schwarzenbronn	1	66	Spruce with silver fir, some beech, Scotch pine, larch. About .6 of area 80—50 years old, some trees older. About .4 of area 10—30 years old. Above the road fairly complete stocking; in youngest parts still suffering from frost; below road still some blanks caused by late cutting out of old trees; in the latter part still 120—150 years old spruce and silver fir in the final stage; these show a decreasing increment. Growth on the whole fairly good.
Schwarzenberg	2	211	<i>a</i> = 180 acres; 15—40 years old spruce and silver fir with some Scotch pine and beech; some lately planted, younger, a few up to 60 years old. About 26 acres planted. Where the shelter wood has been removed, stocking generally complete, in the rest still patchy with patches of bilberry intervening. Growth generally between good and fairly good; along Herrenwies meadows partly only fair, the spruce still suffering from frost. In the north-western part, below the road, on the Riesenköpf road, and in the south-east along Dobelbach, on about 37 acres 110—140 years old spruce and silver firs of decreasing increment are standing in the final stage.

DESCRIPTION OF COMPARTMENTS—*Continued.*

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
Riesenkopf.....	3	76	<p><i>b</i> — 81 acres (in three parts), spruce and silver fir with a few beech and Scotch pine, generally 50—75 years old, but some small groups only 30—60 years old; generally well stocked, here and there somewhat thin and patchy. Growth between good and fairly good. On 8 acres on the Dobelbach, 80—90 years old spruce, cover complete and growth good.</p> <p><i>a</i> — 47 acres; 100—130 years old spruce and silver fir, some older; on the whole cover fairly complete; toward compartment Schwarzenberg somewhat thin, but on about 10 acres with a fair young crop of silver fir and spruce up to 15 years old. Growth fairly good, on the higher part inferior. About 5 acres along the road is a windfall area, now stocked with some silver fir and spruce growth.</p> <p><i>b</i> — 24 acres; 9—20 years old spruce (a few older), with some Scotch pine and larch, mostly well stocked, showing good to fairly good growth.</p> <p><i>c</i> — 5 acres; Grinde, in upper part heather covered, with 100 and more years old short and stunted Scotch pine, some spruce and mountain pine. On the whole poorly stocked. Part underplanted with 20—40 years old spruce, which show very poor growth.</p>
Mehliskopf.....	4	84	<p>50—90 years old (and more), mountain pine with some spruce, Scotch pine, birch and mountain ash; toward compartments 3 and 5 cover fairly complete, in the southern and south-western parts interrupted by larger and smaller areas of heather. Growth inferior.</p>
Grünwinkel.....	5	202	<p><i>a</i> — 136 acres; 110—150 years old, some older, spruce and silver fir, some beech with a few Scotch pine. In irregular final and seeding stage, in the southern part cover still fairly complete in strips. On .4 of the area stocked with up to 80 years old silver fir and spruce and a few beech. Growth of old trees still fairly good; on some stony ridges (about 7 acres) middling and inferior; young growth mostly only middling.</p> <p><i>b</i> — 16 acres on the highest part in the south and west, Grinde; heather-ground with 100 and more years old crippled Scotch pine, spruce, some mountain pine and birch; in some parts up to 60 years old advance growth thinly stocked. Here and there traces of plantings, 24 years old spruce.</p>
Dobelbach.....	6	178	<p><i>a</i> — 133 acres; 100—130 years old, some up to 200 years, spruce and silver fir, some Scotch pine; on the whole cover fairly complete; only in the western third along Grünwinkel through windfalls and dry wood cuttings somewhat thin and patchy; in the thin parts as yet little, up to 15 years old, advance growth in single trees. Growth good to fairly good. (Hex found).</p> <p><i>b</i> — 27 acres (consisting of the upper south-eastern portion and a ridge running from it in a north-western direction to the centre of the compartment), 100—130 years old (some older), short-stemmed spruce with some Scotch pine and silver fir forming a thin, often very thin, wood; in parts younger up to 60 years old spruce, or an incomplete miserable under-</p>

DESCRIPTION OF COMPARTMENTS—*Continued.*

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
			<p>growth of 25 years old spruce and Scotch pine (experimental planting). Growth middling to inferior.</p> <p><i>c</i> = 18 acres (uppermost part on the south) Grinde; heather land with 100 years and more old crippled Scotch pine, some spruce, birch thinly stocked; here and there remnants of 35 years old planted spruce and Scotch pine.</p>
Hoher Ochsen.....	7	101	<p>70 and up to over 100 years old Scotch pine and mountain pine with spruce, some birch, sometimes forming a very thin wood of single trees, sometimes in smaller or larger groups; everywhere intersected by heather places and blanks. Growth inferior, even crippled.</p>
Kleingartenkopf.....	8	76	<p>100—120 years old, in some parts younger, some over 800 years old, spruce with Scotch pine, few silver fir, some mountain pine. In the western third and on the eastern point still fairly well stocked, some groups even well stocked; otherwise the wood is very thin and open. Growth middling to inferior; here and there an incomplete miserable undergrowth of 30—50 and more years old spruce and Scotch pine (planted).</p>
Kleingarten.....	9	362	<p><i>a</i> = 161 acres; spruce and silver fir, some beech. Mostly 50—80 years old, in strips and single trees up to 100 years old, others only 30—50 years old. In the eastern part are about 50 acres 80—100 years old. Everywhere spruce and silver fir standards up to 150 years old, mostly showing good growth. Almost throughout rather thinly stocked, here and there patchy, in consequence of late final cuttings and removal of cancerous silver fir. Growth mostly good, only toward the southern higher part decreasing.</p> <p><i>b</i> = 122 acres (in 8 places); spruce and silver fir with some beech, $\frac{15-40}{\text{average} = 80}$ years old, some groups up to 50 years; mostly fully stocked. 120—150 years old (some older) mostly pruned spruce and silver firs in the final stage are standing almost everywhere over the above younger growth. The strip along Dobelbach is finally cleared. Growth good; of the old trees fairly good.</p> <p><i>c</i> = 79 acres (upper part toward the south), 120—300 years old pruned Scotch pine and spruce, few silver fir and birch, thinly stocked, often open; on the whole poorly undergrown with 20—50 years old spruce (mostly planted), a few silver fir; the latter in some places form, with up to 100 years old spruce, the picture of a selection forest. Soil much covered with heather. Growth middling to bad; rarely fairly good.</p> <p>On 6 acres near compartment Dobelbach on the main path, 100 and more years old spruce, with a few Scotch pine and silver fir, form a thin canopy and show middling growth.</p>
Grossgarten.....	10	175	<p><i>a</i> = 106 acres; spruce and silver fir 80—110 years old, some up to 150, some beech and a few Scotch pine. Partly fully stocked, but the greater part somewhat thin, in the lower part very thin; and here spruce and silver fir advance growth up to 50 years old in single trees and groups. Growth good to fairly good; in</p>

DESCRIPTION OF COMPARTMENTS—Continued.

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
Sachsenbrunn.....	11	95 (and 2 acres other areas.)	<p>the upper parts with stones (Halde), partly middling only.</p> <p><i>b</i> — 87 acres. (Ridge through middle of compartment and strip on south, southwest, and northwest.) 90—110, some up to 200 years old, spruce and Scotch pine, some silver fir, in the uppermost part some mountain pine in a thin, patchy, and often very thin wood; most of inferior growth; here and there traces of 80—40 years old spruce plantings.</p> <p><i>c</i> — 80 acres (adjoining compartment Klein-garten). A wood resembling a selection forest, of spruce and silver fir with beech, the trees 80—60 years old prevailing; little quite young. The 100—120 years old and older trees appear single and in groups. Growth good; above the cattle track inferior.</p> <p>100—120 years old (some up to 200 years), spruce and silver fir, also some beech, namely:</p> <p>On 42 acres, final stage, partly pruned, throughout with $\frac{10-80}{20}$ years old (in the western part up to 40 years old), silver fir and spruce young growth; about 25 acres in the position of the seeding stage brought about by windfalls and dry wood cuttings; on 5 acres 80—100 years old, generally complete cover; in the thinner stocked parts is found up to 15 years old silver fir and spruce young growth; on 12 acres (southeastern corner, near compartment Gartenbach) generally canopy complete, here and there with a little advance growth.</p> <p>On 10 acres (in the west), 70—80 years old, some older spruce with silver fir, fairly complete canopy.</p> <p>On 7 acres (western point), 12—40 years old (in groups and single up to 60 years old), mostly irregular young growth of spruce with some silver fir, forming a fairly complete stocking.</p> <p>Growth of old trees good to fairly good, in the pruned portions partly less good; growth of young wood fairly good.</p>
Gartenbach	12	179	<p>110—140 years old spruce, silver fir, some older, some Scotch pine, the latter prevailing in places in the upper part, few beech; in the northern two-thirds in the final stage, partly in seeding stage. In these two-thirds about 85 acres are stocked with young growth of spruce and silver fir pretty completely, in the eastern part very fully; in the southern third still fairly complete cover, but on the western slope, already somewhat thin, as yet little young growth. Growth in northern two-thirds good, in the southern third good to fairly good; in the upper part, in the southeast, only middling.</p> <p>In the middle of the compartment are 3 windfalls and 1 beetle clearing, together 12 acres; of these, 7 acres fairly well stocked with up to 25 years old spruce and silver fir.</p>

TABULAR STATISTICAL REPORT

COMPARTMENTS.		DISTRIBUTION OF AGE					
		1—40 years old.		41—60.		61—80.	
Name.	No.	Cubic feet.	Acres	Cubic feet.	Acres	Cubic feet.	Acres
I. Working-section—Yield-capacity over							
Schwarzenbronn.....	1	48,080	41	70,680	20		
Schwarzenberg.....	2	200,945	117	166,514	40	122,117	40
Riesenkopf.....	3	19,073	84				
Grünwinkel.....	5	21,189	88				
Dobelbach.....	6						
Kleingarten.....	9	109,479	87	201,299	87	425,737	67
Grossgarten.....	10	26,487	24	46,517	11	25,074	5
Sachsenbronn.....	11	28,806	51			35,516	5
Gartenbach.....	12	18,420	48				
Total.....		467,227	440	488,080	108	676,294	117
Normal state under a rotation of 120 years.....							
Comparison of real and } + normal state.....							
II. Working-section—Yield-capacity from							
Dobelbach.....	6	1,770					
Kleingartenkopf.....	8	10,595	25				
Kleingarten.....	9	10,948	25				
Grossgarten.....	10						
Total.....		23,313	50				
Normal state under a rotation of 120 years.....							
Comparison of real and } + normal state.....							
III. Working-section—Yield-capacity 7							
Riesenkopf.....	8						
Mehlskopf.....	4					18,000	34
Grünwinkel.....	5						
Dobelbach.....	6						
Hoher Ochsenkopf.....	7						
Total.....						18,000	34
Normal state under a rotation of 120 years.....							
Comparison of real and } + normal state.....							
Summary of the							
Real state of forest.....							
Normal state of forest.....							
Comparison of real and } + normal state.....							

OF THE HERRENWIES RANGE.

CLASSES.						Volume per acre, cubic feet.	INCREMENT.			
81-100.		Over 100 years.		Total.			Annual, per acre.		Total in 10 years.	
Cubic ft.	Acres	Cubic ft.	Acres	Cubic ft.	Acres		Normal	Real.	Normal.	Real.
43 cubic feet per Acre Annually.										
15,893	2	84,260	4	152,910	65	2,852	85	70	55,260	45,500
		113,632	12	697,130	211	8,304	85	75	179,850	158,260
		881,408	87	400,490	71	5,641	70	61	49,700	43,810
		1,606,861	143	1,628,060	186	8,758	85	71	158,100	132,080
		1,522,104	188	1,522,104	188	11,444	100	71	188,000	94,480
358,156	49	540,329	43	1,628,060	283	5,758	100	73	238,000	220,740
494,418	49	865,870	49	968,496	188	6,945	85	85	117,800	117,800
42,370	5	459,108	84	585,408	95	5,952	100	71	95,000	67,460
		1,878,768	124	1,887,178	172	8,065	100	86	172,000	147,980
905,845	105	6,402,845	534	8,989,771	1,354	6,603		76		1,026,980
				7,456,200		5,507	92		1,242,700	
				1,438,571		1,066				
								16		5,740
7 to 43 cubic feet per Acre Annually.										
		88,860	27	40,620	27	1,504	80	21	8,100	5,670
		208,418	51	214,018	76	2,816	14	14	10,640	10,640
		108,419	54	119,897	79	1,511	43	39	88,970	22,910
		79,460	87	79,460	87	2,148	21	21	7,770	7,770
		430,147	160	458,480	219	2,071		21		40,990
				862,880		1,657	28		60,480	
				90,580		414		7		18,460
cubic feet and under per Acre Annually.										
		4,500	5	4,500	5	900	7	7	850	850
				18,900	34	555	7	7	2,880	2,880
		11,800	16	11,800	16	706	7	7	1,120	1,120
		7,400	18	7,400	18	411	7	7	1,280	1,280
		58,400	101	58,400	101	529	7	7	7,070	7,070
		76,600	140	95,500	174	549		7		12,180
				78,080		430	7		12,180	
				22,420		120				
Three Working Sections.										
				9,488,781						1,066,180
				7,892,160					1,815,860	
				1,596,571						229,330

ANNUAL REPORT OF SPECIAL WORKING PLAN.

COMPARTMENTS.	DESCRIPTION OF CUTTINGS, CULTIVATION, ETC.	CUTTINGS.		Cultivation. Acres.	Drainage Ditches. Feet.	Road Construction. Feet.
		Final. Cubic feet.	Intermediate Cubic feet.			
1. Schwarzenbronn...	Final cutting in regenerated part.....	84,000	.....	.....	.....	.....
	Filling up blanks with spruce.....	.....	.....	8	.....	.....
	Thinning and cutting of cancerous silver fir....	.....	10,000	.....	.....	.....
	Total.....	84,000	10,000	8	.....	.....
2. Schwarzenberg....	a Thinning of shelter-wood and partial final cutting.....	85,000	.....	.....	.....	.....
	Filling up blanks with spruce and Scotch pine. a and b Thinning and removal of cancerous trees.....	.....	88,000	10	.....	.....
	Total.....	85,000	88,000	10	.....	.....
3. Riesenkopf.....	a Seeding cutting, and partly final cutting. b and c Rest.	58,000	.....	.....	.....	.....
	Total.....	58,000	.....	.....	.....	.....
4. Mehliskopf.....	Rest.					
5. Grünwinkel.....	a Thinning of shelter-wood, seeding cutting in the fully stocked parts by the removal of cancerous and large trees.....	818,000	.....	.....	.....	.....
	b Rest	.....	.....	.....	.....	.....
	Total.....	818,000	.....	.....	.....	.....
6. Dobelbach.....	a Thinning and removal of cancerous trees.....	19,000	19,000	.....	.....	.....
	b and c Rest. Construction of an export road to meet the main road.....	.....	.....	.....	.....	4,900
	Total.....	19,000	19,000	.....	.....	4,900
7. Hoher Ochsenkopf	Rest.					
8. Kleingartenkopf..	Rest.					

SPECIAL WORKING PLAN—*Continued.*

COMPARTMENTS.	DESCRIPTION OF CUTTINGS, CULTIVATION, ETC.	CUTTINGS.		Cultivation. Acres.	Draining Ditches. Feet.	Road Construction. Feet.
		Final. Cubic feet.	Inter-mediate Cubic feet.			
9. Kleingarten.....	<i>a</i> Cutting of all old standards and cancerous trees.....	45,000	8,000			
	Thinning.....					
	<i>b</i> Thinning of shelter-wood and partially final cutting.....	198,000				
	Filling up blanks with spruce.....			12		
	<i>c</i> Cutting out of old defective trees where young growth exists....	14,000				
	Construction of an export road to meet the main road.....					9,500
	Total.....	257,000	8,000	12		9,500
10. Grossgarten	<i>a</i> Thinning and removal of cancerous trees.....	47,000	47,000			
	<i>b</i> Rest.					
	<i>c</i> Removal of standards and cancerous trees....	25,000	15,000			
	Thinning.....					
	Construction of an export road.....					5,000
	Total.....	72,000	62,000			5,000
11. Sachsenbronn....	In the regeneration area: thinning of shelter-wood and partially final clearing; in the rest seeding cutting.....	168,000				
	Filling up blanks with spruce.....			8		
	Construction of an export road.....					8,500
	Total.....	168,000		8		8,500
12. Gartenbach.....	Continuation of regeneration cuttings and removal of cancerous trees.....	195,000				
	Thinning in fully stocked parts.....		7,000			
	Filling up blanks with spruce and Scotch pine.			8		
	Construction of an export road.....					8,000
	Total.....	195,000	7,000	8		8,000

SUMMARY OF THE PROVISIONS OF THE

COMPARTMENT.	PROVISIONS OF WORKING PLAN.					
	Cuttings.			Cultiva- tion. Acres.	Drain- ing. Feet.	Road Con- struction.
	Final. Cubic Feet.	Inter- mediate. Cubic Feet.	Total Cubic Feet.			
1. Schwarzenbrunn.....	84,000	10,000	44,000	8	.....	.....
2. Schwarzenberg.....	85,000	58,000	88,000	10	.....	.....
3. Riesenkopf.....	58,000	.....	58,000	.....	.....	.....
4. Mehlskopf.....	.....	.....	.....	.....	.....	.....
5. Grünwinkel.....	818,000	.....	818,000	.....	.....	.....
6. Dobelbach.....	19,000	19,000	88,000	.....	.....	4,900
7. Hoher Ochsenkopf...	.....	.....	.....	.....	.....	.....
8. Kleingartenkopf.....	.....	.....	.....	.....	.....	.....
9. Kleingarten.....	287,000	8,000	200,000	12	.....	9,800
10. Grossegarten.....	79,000	62,000	184,000	.....	.....	5,000
11. Sachsenbrunn.....	168,000	.....	168,000	8	.....	3,500
12. Gartenbach.....	195,000	7,000	202,000	8	.....	8,000
Total.....	1,146,000	154,000	1,800,000	86	.....	25,900

NOTE.—The excess was due to heavy windfalls; it will not derange future

WORKING PLAN AND OF THE EXECUTION.

RESULTS OF ACTUAL WORK DONE.						COMPARISON OF PROPOSED AND EXECUTED CUTTINGS.		Remarks.
Cuttings.			Culti- vation. Acres.	Drain- ing. Feet.	Road Con- struc- tion. Feet.	Cut too much. Cubic Feet.	Cut too little. Cubic Feet.	
Final. Cubic Feet.	Inter- mediate. Cubic Feet.	Total. Cubic Feet.						
88,084	12,549	45,588	4.4	.....	.....	1,588	.....
54,617	75,000	129,517	5.0	.....	.....	41,617	.....	Excess due to windfalls and snow-break.
182,900	.....	182,900	.1	.....	.....	79,900	.....	Excess due to windfalls and snow-break.
177,169	.....	177,169	.1	.....	.....	.....	140,881	Held back, on account of ex- tra fellings in other compts.
86,006	68,801	154,907	.....	.....	5,008	116,907	.....	Excess due to windfalls.
842,444	21,886	864,079	8.4	.....	9,979	104,079	.....	Excess: wind- falls and con- struction of road.
95,862	.....	95,862	.....	.....	5,299	.....	88,148	Thinning held over.
111,049	.....	111,049	.9	.....	3,001	.....	51,951	Held back on account of ex- cess in other compartments
197,000	.....	197,000	.....	.....	2,958	.....	4,840	
1,231,231	177,485	1,408,716	18.9	.....	26,625	108,716	.....

arrangements, as there is yet a considerable excess of growing stock in the forest.

SAMPLE PAGE OF THE DETAILED CONTROL BOOK.

1. *Schwarzenbronn.*

Year.	Description of Cuttings, Cultivation, etc.	CUTTING.		Cultivation. Acres.	Draining Ditches. Feet.	Road Construction. Feet.
		Final Cubic feet.	Inter- mediate Cubic feet.			
<i>Provision of Working Plan.</i>						
	Final cutting in regenerated part..	84,000				
	Filling up blanks with spruce			8		
	Thinning and cutting of cancerous silver firs		10,000			
	Total	84,000	10,000	8		
<i>Execution.</i>						
1884	Final cutting	14,297				
1884	Dry and windfall wood	813				
1885	Windfalls	685				
1886	Final cutting, thinning	6,166	862			
1886	Windfalls	547				
1887	Windfalls	1,963				
1888	Final cutting, thinning	7,759	11,717			
1888	Planting			1.7		
1888	Windfalls	82				
1889	Dry wood, windfalls	649				
1889	Planting			2.2		
1890	Windfalls	698				
1890	Planting .....			.1		
1891	Planting .....			.2		
1892	Planting .....			.1		
1893	Planting .....			.1		
	Total	88,064	12,549	4.4		



View of west end of Pelican Lake. Indian village on the right. Photographed Aug. 16, 1904, for the annual report of the Chief
(Forest) Fire Warden of Minnesota.

SOME NOTICES OF THE PRESS DURING THE PAST TEN YEARS.

The principle on which the present work in Minnesota is based is that *prevention* of fires is the chief remedy. * * This report is one of the most valuable documents of its kind which has been published. * * It will be widely called for, and gives an object lesson to other parts of the country.—*Boston Herald* (1896).

The annual report of the Chief Fire Warden of Minnesota, Mr. C. C. Andrews, is a document of value to all interested in forestry. As Mr. Andrews says, when people understand the benefits to be derived from a rational management of our forest lands, then, and not till then, will there be a public sentiment that will make the Fire Warden Law as effective as it should be. The attempt which Minnesota is making to prevent forest and prairie fires is indeed a commendable one.—*Outlook* (N. Y.)

Very notable contribution to the literature of forestry.—*American Lumberman*.

Since the establishment of the office the state has been singularly free from destructive fires.—*Minneapolis Lumberman*.

Apart from the importance of the subject, the masterly way with which it is handled makes this report of 137 pages a gem of its kind. This compilation of data represents an immense amount of painstaking labor, on which an active mind and a strong hand has done first-class service.—*St. Louis Lumberman*.

The Fifth Annual Report of the Chief Fire Warden of Minnesota is not exactly a magazine, but it has illustrated pages, it deals with nature, and it is full of information about forests in this and other countries. Don't fail to get this report. It is exceedingly valuable. Here is a chance for the schools to become intelligent concerning our Minnesota forests and concerning forestry generally.—*School Education*.

A most interesting document. * * This movement is full of hope for the future of American forests.—*Chicago Standard*.

The public mind needs to be educated on the subject, and a report like this will have an excellent effect.—*Minneapolis Journal*.

State document of great value.—*Farm, Stock and Home*.

Gives evidence of able and energetic work on his part.—*Popular Science Monthly*.

This document gives a great deal of valuable information. * * The letters sent by the fire wardens and others throughout Minnesota to their Chief in reply to his circular of inquiries are remarkably intelligent and interesting.—*American Architect and Building News* (Boston).

We should like very much to see it duplicated in Wisconsin.—*Eau Claire Leader*.

Exhibits the fact that the Chief Fire Warden is in close touch with the fire wardens in each town in the state.—*Roseau Times*.

The Minnesota law is one of the best and most progressive in force in any of the states.—*Gifford Pinchot, Chief of the U. S. Division of Forestry*.

RESOLVED, As a fundamental proposition of rational forestry, we commend the well-organized effort of the State of Minnesota to suppress forest fires, being aware that no advance can be made in forest management without such protection.—*Resolution adopted by the American Forestry Association*.

Under the vigorous administration of the present Chief Fire Warden much has been done to promote the growth of a correct public sentiment and not a little has been accomplished in the actual prevention and suppression of fires.

Warning notices in great numbers have been posted and the intelligent co-operation of a large force of assistant wardens has been secured. During the drought in the early summer of the present year over 300 fire wardens were in correspondence with their chief, reporting precautions taken, and otherwise showing their interest and activity. The system is doubtless capable of improvement, but in its inception and reasonably successful working a great step has been taken, and by so much Minnesota is well in advance of Michigan and Wisconsin.—*Prof. V. M. Spalding of the University of Michigan, in "Science" for December 28, 1900*.

Minnesota is taking a foremost place among the commonwealths that are giving attention to forestry. The annual reports of General C. C. Andrews' really forestry reports, are of great interest and value.—*Democrat Chronicle, Rochester, N. Y. (1901)*.

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